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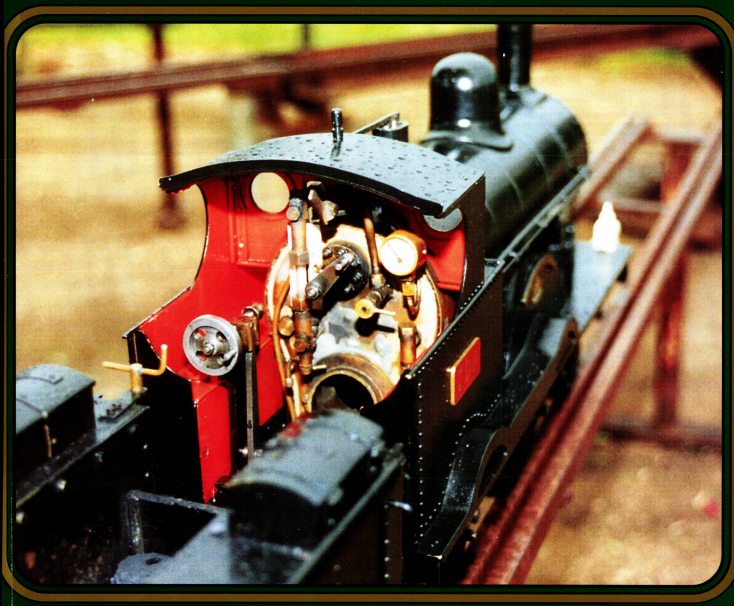

LOCOMOTIVES, TRACTION & STATIONARY ENGINES, BOATS, WORKSHOP, PRODUCTS, CLUB NEWS & EVENTS, REVIEWS

In This Issue:
- ☑ The 40th AALS Convention
- ☑ The Ultimate User Friendly Turnout?
- ☑ Injector Testing with a Boiler Simulator

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Contents

The Cover

A cab view of "Hardwicke" — Hugh Elsol's magnificent 3½" gauge 2-4-0 based on the 1874 LNWR "Precedent" class. For a full introduction to the construction of this loco turn to page 9.

Photo: Brian Carter

Australian Model Engineering

Crew

Comment

Doing our own thing

I drove back home from Wagga Wagga — from the AALS inter-club run in May — with a feeling that I can only describe as glowing. Some, I know, would say it was the blood vessels reacting to a thick coat of steam oil! But it was more than that: I had a feeling of having enjoyed myself almost more than I deserved. It was a mixture of steam, old and new friends, a great evening out to dinner, and surroundings and hospitality for which Wagga Wagga is legendary.

A month previously I'd enjoyed myself greatly with friends at Galston, and a month before that at Penfield during the Convention. The hospitality in both cases was outstanding. I counted myself lucky to be part of such a friendly hobby.

Do we all get so much enjoyment from running our locomotives, traction engines, boats and so on?

A few days after I returned from Wagga Wagga, a friend who had been there sent me a note — and he ended "I only hope *They* don't find out how much enjoyment we get out of these things — or they'll try to tax it, or take it away from us!"

Another model engineer I know has a marvellous time running his locomotive and doing hands-on jobs for his club. He retired fairly young and spends most of his waking hours building locos. When people ask him why he spends so much time on his hobby, he simply stares up to heaven and says "I've got no guarantee they have workshop facilities up there!"

Thinking about enjoyment of one's hobby reminded me of an article on model railroading in the *Smithsonian* magazine a few years ago. It was followed by some reflections of a model railroader: "One of the attractions of model trains is the control. When you want them to go, they go; when you want them to stop, they stop. Such control in real life is unheard of. I know; I have four daughters and a dog."

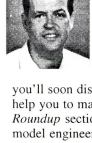
I suppose the control element is *part* of the explanation for our hobby's appeal. But there are other dimensions: there is the pleasure of concentrating solely on a problem to squeeze out the best solution; there is the giving and taking of all sorts of tips and advice; there is the great sense of shared purpose in what we do; there are the many retired people who help and guide those of us with less experience and time, and who — unlike most older members of our communities — are greatly valued for their knowledge.

But I wonder if above all this is the feeling that we are *making our own fun*? In model engineering, we are at the other end of the spectrum from the *pre-manufactured* entertainments that preoccupy many people nowadays. Not for us the formula that some tycoon has thought up for us, which will leave us no richer — in spirit or pocket — for the experience. We do what we want to do.

If ever "doing your own thing" described a hobby, it describes ours. To which I would add "... with a great bunch of friends".

Clive Huggan

This is an open invitation, during 1996, for all model engineers to tell us how you find "Model Engineering — an Enjoyable Hobby". Thanks to those who have already sent in material... bmc.



To our new reader

If this is your first issue of Australian Model Engineering, welcome!

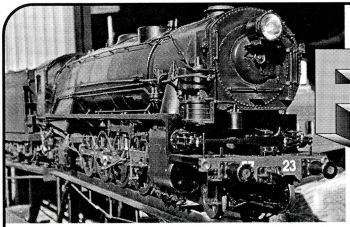
We hope you'll look forward to the ideas, news and camaraderie in each bi-monthly issue.

One of the great things about our hobby is the way model engineers actively help each other. Unless you live in an isolated community, you'll soon discover who has valuable experience in your field of interest, or who will help you to make a part that's too big for your workshop machinery. Look in the *Club Roundup* section to find a club that's near to you; pay a visit and you'll usually find model engineers who live not too far away. Then you can experience the great fellowship that makes our hobby special.

This magazine is prepared in the same spirit of "model engineers helping each other". About two dozen people put many hundreds of hours work into each issue — all on a voluntary basis — to help model engineers in Australia and New Zealand keep up to date and stay in touch.

We rely on our readers to write articles for us — for the same (non-existent) rate of pay! If you have ideas or techniques that you feel would be interesting to others, please drop us a line. We'll gladly help with preparation of artwork or editing if that's necessary. Most important of all, please support the people who advertise in our magazine. Without them to pay the bills, you wouldn't be reading this!

Brian Carter



For Sale

A superb example of the modelmaker's craft is being offered for private sale

'Big Engine' No. 5723 is a 71/4 inch gauge, live steam model of one of the most powerful goods locomotives to operate on the NSWGR.
Built by Frank Fitzgerald, and completed early in 1991. 5723 successfully completed its first run at the Western Districts Live Steamer's club track at Fairfield NSW where it has mainly operated.

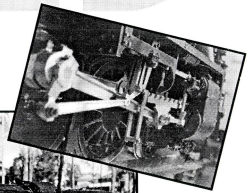
The locomotive statistics include:

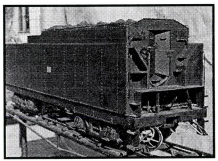
A copper boiler with a current AMBSC certificate.
Fabricated three-cylinder block.
Main driving wheels have cast iron hub with shrunk and riveted steel tyres.
Driving wheel axles have split white metal bearings, all other axles fitted with needle roller bearings.
Fully operational conjugating valve gear with cast main bronze bearings.
Fabricated trailing truck.

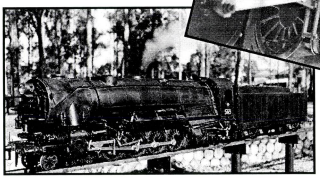
Tender details:

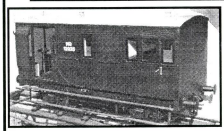
Body fabricated from brass sheet and assembled with 4500 1/16" diameter copper rivets.
Fully detailed.

Loco & Tender Length: 3353mm (11ft.)
Weight: 662 kg. (13 cwt.)
Tender: 60 litres water cap. (15 gal.)

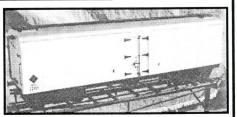








Also included (or available separately) are these two exquisite NSWGR freight wagons. Left: HG guards van Right: MRC refrigerator



For more information about this unique model, please contact
Bernie Fitzgerald on (066) 52 1083 or (02) 773 3022
or bernie@midcoast.com.au

A Little "Jumbo"

Locos don't have to be big — just big-hearted

by Hugh Elsol

Drawings for publication by Dave Adams. Photos by the author unless otherwise noted.

During 1994, my 3½" gauge LNWR 2-4-0 *Jumbo* No.790 *Hardwicke* entered service at QSMEE's Warner track. With the trend to bigger locomotive projects and with inside cylinders and motion, the little *Jumbo* may have been viewed by some members as a lot of work for little result. Its performance on the track certainly lays to rest any idea it is just a little toy! The *Moorabbin Small Gauge Revival* in March 1995 prompted me to write.

During July-August of 1895, the east and west coast railway companies in Britain reduced journey times on the overnight trains from London to Scotland in what became known as the 'Races to the North'. Fast test sectional times were run on "The Premier Line" by LNWR's *Jumbo* No.790, *Hardwicke*. This article explains my choice of a 3½" gauge project and furthermore examines the positives in building smaller instead of larger steam locomotives.

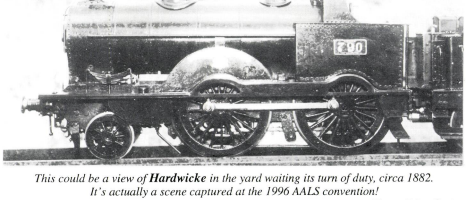
LNWR, NO. 790, ***Hardwicke.***

Photo: Brian Carter

The most popular live steam locomotive gauge in Australia is 5". AALS convention lists reveal this, but they also show a growing trend towards 7¼" gauge. So, when I began to consider construction of a locomotive in the late 1970s, for me it was 5" gauge first and other considerations last. I wanted a simple, compact tender engine: Don Young's *Rail Motor* No. 1 was selected and was completed during 1986. It has given many years of pleasure since, running on both ground and elevated tracks at home and interstate. The engine weighs 70lbs and is not very long. So I can transfer it unassisted to and from the Commodore wagon. Most other 5" gauge engines are too long for single-handling.

I had read about the 'Races to the North' and made some calculations as to the size of a 5" gauge *Jumbo*, indicating a locomotive longer and heavier than *Rail Motor*. Despite the small size of *Rail Motor*, the short, stubby boiler steams well and the 1¼" bore cylinders give ample power. I'm neither technically trained nor employed in a technical field: *Rail Motor* is consequently "rough". I reasoned that a 3½" gauge *Jumbo*, though smaller, if fairly well constructed should not only be hip-pocket-size but also capable of spirited performance. At our track, Harry Piggott's *Tich* and other members' *Rob Roys* always give their owners enjoyable circuits on our elevated track.

Track availability seemed the only disadvantage. I have long legs and prefer the comfort of elevated tracks anyway. QSMEE's



This could be a view of ***Hardwicke*** *in the yard waiting its turn of duty, circa 1882. It's actually a scene captured at the 1996 AALS convention!*

Photo: Brian Carter

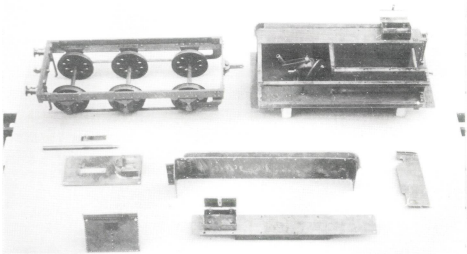
elevated track has been extended recently (*see the article by John Elsol in the May-June 1996 issue of AME... ed*). Good, interesting 3½" gauge tracks still exist in NSW and Victoria. Scale rolling stock construction does not particularly interest me because my idea of fun is non-stop running — the lack of signal checks and points on (most) elevated tracks therefore is quite attractive. And my ambition has never been to stop with one prototype: so many steam locomotives interest me that I will always be thinking of that next locomotive and how to make its workmanship better than the previous one!

I followed LBSC's plans for his 3½" gauge *Mabel,*and I visited the UK in January 1989 to see the preserved locomotive at the National Railway Museum at York. Using 1000 ASA Kodak print film, on sale at the museum, plenty of details were captured so that the little addition could be made to look authentic. Like LBSC, I build engines to run — fine detail is pleasant but is not paramount. The visit to the NRM was useful to determine rivet spacings especially, so the tender in particular looks right: these rivets are 3⁄64" diameter. Other details captured photographically included sand boxes and covers, hand rails and number and name plates, which add so much to the character of the locomotive.

The AMBSC Code required a redesign of the boiler as LBSC drew it, especially in bush size for fittings and plate flange engagement depth: the Code requires a separate bush. It was difficult to keep the manifold, top glass fitting and pressure gauge mounting within the scale-sized cab. Therefore, these three bushes are in front of the spectacle plate, with mountings running back through it. I felt it was safer to employ two safety valves with 5⁄32" openings in place of one of 7⁄32". These two plain valves fit inside the scale-size casing with its dummy Ramsbottom's lever. Additionally, the firehole ring was enlarged to 1⅛" diameter to improve firing; this meant the cab floor had to be lowered. A drop-down firehole door was also fitted — it's easy to open and shut in a confined cab.

One excellent feature is the cross-head pump, which maintains the water level easily. There seem to be fewer resistance problems with its long stroke and small bore. By contrast, *Rail Motor's* axle pump was quickly dispatched to the scrap bin when it was found to make the engine so jerky; therefore its injector has been used ever since and I am not keen on axle pumps. Notwithstanding the confined location of *Hardwicke's* pump inside the frames, I can repack its gland if need be. It has Teflon® packing, which so far has been trouble free.

Most consider *Rail Motor* to be very small, and are quite surprised at the speed it runs! *Hardwicke*, also, is an uncommonly swift runner but is even smaller. Extension of QSMEE's elevated track to 180 metres or about 600 feet during 1994 with two long straights lets *Hardwicke* circulate quickly indeed: speed is only limited by the driver's bravery! It steams really freely — much better than *Rail Motor* — and is particularly frugal with coal.



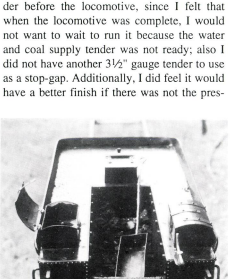
Tender, showing pre-fabricated platework before sweating. Note handpump and access cover.

The boiler is lagged with a fibreglass matting material, about 1⁄32" thick. Exhaust is sharp and loud. I based the exhaust clearance on the valves per LBSC: it must work! The design and resultant performance are a great tribute to the skills of the late LBSC.

Hardwicke's appearance is as before the rebuilding of the 1890s. No coal rails are fitted to the tender and the coupling rods are plain, not fluted. It was spray painted gloss black with an airbrush; the fine lining is a job for the future.

Tender chassis

As with *Rail Motor*, I completed the tender before the locomotive, since I felt that when the locomotive was complete, I would not want to wait to run it because the water and coal supply tender was not ready; also I did not have another 3½" gauge tender to use as a stop-gap. Additionally, I did feel it would have a better finish if there was not the pressure of rushing to go for that 'first run'. Rough looking tenders spoil neat locomotives. For the same reason, I arranged a suitable adapter ring for the blower as soon as the chimney was turned.



Fireman's view of the tender highlighting the tool boxes.

The tender chassis was therefore the first job. 1" by ¾" section ⅛" angle made the chassis sides. 1" by ⅛" plate and 1" by ⅜" plate formed the beams. It was straightforward, especially with the standard English six-wheel layout and LBSC's suspension method of coils located in cast dummy leaf springs. On a small 3½" gauge locomotive, brakes seem superfluous. Although fitted to the prototype, brakes have been omitted from the model. In retrospect it would have been easy to include non-working blocks. It could be done if I become inspired in the future — removal of four hex-headed screws will allow the body to be easily separated from the chassis.

Wheels are pressed on to the axles. The clearances are about one thousandth of an inch. This proved a bit tight for one wheel boss, which cracked. However, the crack was minor; given that the tender weighs just 16lbs, there seems little danger of failure in service. Overall dimensions are 16" long, 6 3⁄16" wide and 7" high over the tool boxes. Wheels are 3" diameter with 10 spokes.

Tender platework

Rail Motor has a brass tender body, with predominantly flat sheets riveted to 1⁄16" brass angle. Though I am happy with it, I felt I'd prefer to have real rivets without the difficulties of dollying them over in confined spaces. I built the chassis and hacksawed out the 16 gauge soleplate while considering how best to tackle the body. At this stage all I decided was that 3⁄64" brass rivets would look about right. So I bought 1,000 of them.

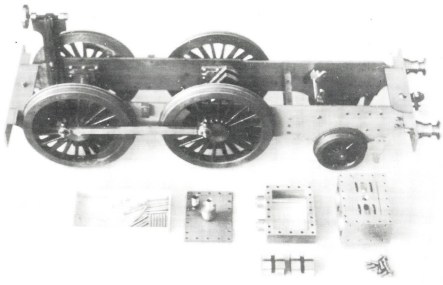
A valance runs down the sides about 5⁄8" from the front, and around the rear. Handrails, fixed extensions at the front sides and steps add to its appearance. The soleplate is the coal

bunker floor so the water tank is shaped like the base of a capital H at the front. A frame to follow the outside shape was silver soldered from 5/16" square brass bar. Tapped holes for 7 BA hex screws were provided in the sides of the bunker before silver soldering and 8BA in the other parts for the outside side plates. The curves of the side plates were filed into this frame on the four main corners. A duplicate frame for the top was made, connected via the side plates.

The full-size tender body has three main side plates. Two run outwards from the bunker, curve 90° and run down the sides, curve 90° again and finish roughly a quarter of the distance across the back. At the back, the side plate sheets overlap a short third sheet. Butting them together seemed better for water sealing later on. The side plates were cut from 18 gauge brass and formed "copper boiler style" by annealing the sections that had to be curved and then shaping them over a hardwood former. Both sides came out the same length. No rivet holes had been drilled at this stage.

The soft annealed corners were easily aligned on assembly; they were screwed 8 BA countersink to the brass frames. Riveting was the easiest of the jobs. Spacing was a holdup for some time. In the end a spacing wider than scale was determined, to make it look right. This spacing was decided after experimenting on scrap pieces. Horizontally it is 1/8" and vertically 1/4".

A mild steel former for the rivet holes kept the lines straight and all holes on curved sections were drilled by hand. This is where I broke three No. 56 drills! Next the sheets were turned over and the holes were countersunk, rivets were cut a little over length with pliers, a 1/16" or so, and the rivets were dollied over. A scrap piece of 1/16" brass was annealed and when placed under the rivet heads to prevent head damage. The quickest method was to do each rivet singly i.e. cut, dolly, cut, dolly etc. When all were in place the inside of the plate was filed flush (I used a sharp new file for this). Fitting the plates revealed minimal distortion.



Chassis showing cylinders, steam chest and valves. Note lubrication groove ahead of front steam port.

The valance strips were similarly treated, except that every sixth rivet was used to hold them on. The valances are reinforced with half-round brass rod which is riveted. After the holes were drilled, both the rod and the plate were countersunk. With annealed rivets the head filled out in the countersink in the rod. Both sides were filed flush. All this platework was very satisfying on completion, and it was an easy construction method.

The tool boxes, a prominent feature of the tender, were interesting items to construct. The bodies were cut out of thin brass with tinsnips, folded and carefully silver soldered. The sides were cut as a strip, folded three times, the base was a rectangle. Rusty iron wire and gravity held the job. With care, the brass will not melt — just be judicious with the heat. Two hinges per lid and 1/4" strap to hold the lids shut complete the boxes. The hinges have 1/16" pins through 3/32" rod. Hinge straps were riveted to the body. A 1/16" rivet in the side of the box, head inside, secured with a little soft solder engages with a hole in the strap. There is sufficient 'springiness' in the thin brass for the lids to open yet remain shut when closed. They were easier to construct than this description would suggest and, incidentally, the brass straps represent leather straps from the full-size *Hardwicke*.

One of LBSC's "two hour" hand pumps, 1/2" bore, is fitted. Naturally, I couldn't match LBSC's two hours — I took considerably longer. The filler lid is in prototypical position and a small removable rectangular section (2" by 1/2") to the rear gives access for the pump handle. This plate sits flush with a lamp iron bracket as a handle to lift it off. It is also useful for checking the tender water level, so the cross-head pump by-pass exit pipe is there. For maintenance access, the rear inner top section, 6" by 2 3/4", is held by six 8BA countersunk screws.

A small propane torch on gentle gas flow was used to run soft solder around the inside of the tender body. Any solder which ran out had to be filed off, but I basically just swished the liquid solder about. The two butt joins at the rear have extra 1/2" brass strips inside to hold the solder. After sweating, all that remained was to cover the 8 BA countersunk screws holding the plates to the frame. This was achieved with a soldering iron which kept the heat localized to the screw heads. Careful filing cleaned up these spots of solder to complete the tank body.

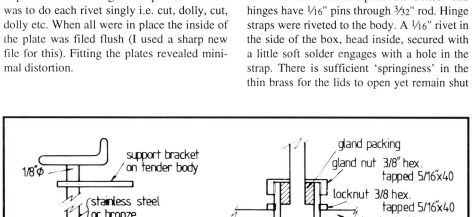


Fig 1 VALVE, BODY & HANDLE

Water feed and connections

It seemed advantageous to have the same sized water connectors on locomotives, so *Rail Motor*'s 5/16" plastic hoses and fittings were copied. The brass fittings are 3/8" hex with 5/16" Whitworth threads and 1/8" bore. Though I now think cones are better than the parallel faces, my connectors do not seem to leak air or water.

The injector water valve is on the tender with a design and location making it look like a brake handle. It is as simple as I could make

it and is a variation of taper plug cocks except the plug is parallel. The disadvantage is that water leaks slowly but at least this keeps the injector cool! The parallel design reduces the potential sources of air leaks because only a top packing gland is needed. The plug is in a blind body. On the next tender however, I will make the valve *inside* the water tank so valve air leaks will be a thing of the past. Figure 1 shows the design.

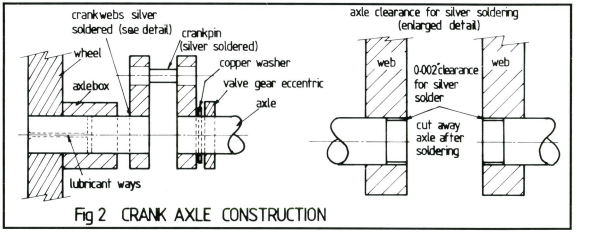


Fig 2 CRANK AXLE CONSTRUCTION

Locomotive chassis

Standard LBSC construction of the chassis was followed — no difficulties were experienced. The beams are angle with slots for the plate frames and short pieces of angle riveted each side where hex steel screws hold them to the frames. The inside cylinder block and Allan valve gear frame act as stretchers at the front. There are no other stretchers. Beams and frames are ⅛" thick plate.

Frames are 17⅞" long, 3" deep at the leading wheels but 2" deep otherwise. 6" wide 1" x 1" angle forms the buffer beams. Overall, the locomotive is 18¼" long, 6⅜" wide and 10⅜" high at the chimney. Leading wheels are 2¼" diameter with 10 spokes; coupled and driving wheels are a whisker under 5" diameter and have 20 spokes.

Hornblocks for coupled and driving wheels are riveted to the frames, the leading wheels having ⅜" square steel cheeks riveted inside the frames. The axleboxes have plain bearings. The wheels were pressed on to the axles, with the coupled and driving wheels secured by 1/16" diameter pins. Quartering was done in the lathe. Frame alignment was carried out on the lathe bed by inverting the frames. ⅛" packing kept them level where the frames are lower in front of the driving axle.

Crank axle and eccentrics

All workshops have interesting scrap bins: my bin has two crank axles and one set of eccentrics straps! They were not right, so they were given the sword.

LBSC describes inside cylinder crank axle construction employing press fits and pins. My first axle was sliding fits and silver soldered — it was just fine until I left it in phosphoric acid to clean up for too long. The consequence was an axle one thou too small all over. The second was press fit and pin per LBSC but in service the left hand web shifted on the axle and therefore required replacement. Of course, the platework, boiler and smokebox and eccentric straps had to come off, which requires the removal of twenty screws and five pipe connections — half an hour's work! I salvaged the four eccentrics and two crank webs, made a new axle and silver soldered the third attempt together. After soldering, the webs were cleaned, then soldered to the axle. Next the axle was cut and filed between the two webs. To retain free eccentrics, two copper washers separated them from the webs; the axle was machined to two thou silver solder clearance for half web width in four places. It worked very well: see fig. 2.

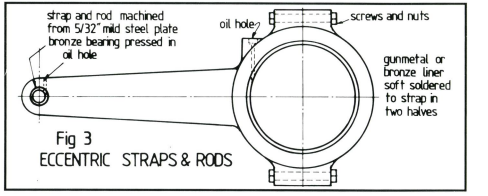


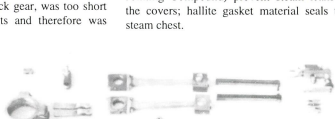
Fig 3 ECCENTRIC STRAPS & RODS

The first set of eccentric straps were machined okay, but the rods were silver soldered on, and I found they were not all in line afterwards. So another set was fabricated from 5/32" plate steel with strap and rod in one piece. Eyes were silver soldered and gunmetal liners were sweated in place. Four sheets were riveted into one after each had been split and screwed together. All were hacksawed, milled and bored to size before separation. This was easy. One strap, left back gear, was too short for correct valve events and therefore was lengthened 30 thou blacksmith style. Wet cloth was tied around the strap eye and eccentric liners with wire while the centre was heated to red with oxy and stretched by hitting with a punch and hammer.

Cylinders and motion

Inside cylinders bolted to an angle plate mounted on a face plate are simply machined by moving the angle plate for the second bore. Both bores must be, and were, parallel to each other. It was gratifying to machine the cylinders accurately. They are 1⅛" bore by 1½" stroke. Oil feed is underneath. A 1/16" hole was drilled up to the port face where — using a dental burr in a home-made holder — a 1/16" wide groove about 30 thou deep was milled across in front of the steam ports. The valves sweep oil from the groove.

Stainless steel studs with brass nuts secure the steam chest to the cylinder block. At first I had steel nuts, but since the chest cover is also the smokebox floor, I replaced them. Cylinders, pistons, chest and valves are non-ferrous, so the pistons are packed with graphited yarn. Brown paper gaskets with Dixon's (Pipe Jointing Compound) prevent steam leaks at the covers; hallite gasket material seals the steam chest.


Inside valve gear links.
Eccentric straps and rods are the set that were scrapped.

With the exception of the fabricated eccentric strap eyes, all the motion is machined from solid. This allowed all parts be case hardened. Only the guide bars are non-hardened mild steel; crossheads are cast iron so the guides do not need hardening. Connecting rods were cut from 3/16" steel plate. Big ends are two pieces of cast iron that were sweated together for machining. To drive the crosshead pump, the right hand gudgeon pin is longer to hold the drive arm while the right hand valve rocker also extends downwards more than one inch to drive the lubricator, which is mounted beneath the front buffer beam.

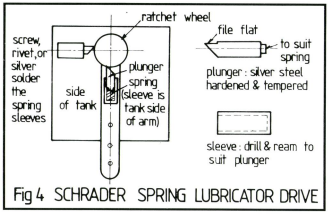


Fig 4 SCHRADER SPRING LUBRICATOR DRIVE

Careful fitting and machining was needed. Clearances are extremely tight so the motion just fits. There is no extra room! Eccentrics are nipped to the axle by two hardened grub screws each, set 90 degrees apart. When the valves were correctly set, each screw was removed to dimple the axle with a hand drill. Then the screws were tightened for good.

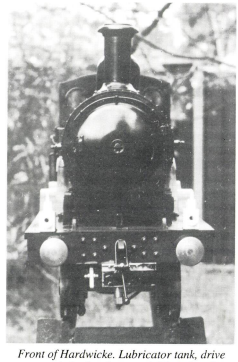
Valve pins are 1/8" silver steel. If the rods were too close for nuts, then eyes were counter-sunk before case hardening so that pins could be dollied over and filed to clear (if necessary). Those nutted are 8BA with thin 3/16" diameter washers. This is one description that has taken much less time to write than it did to carry out! It was a great relief when all the motion fitted and worked.

Lubricator

LBSC's standard oscillating cylinder type lubricator provides plenty of oil to the cylinders. It has a 3/32" bore with a 1/4" stroke. The LBSC pawls were not used on my *Rail Motor* lubricator because I experienced difficulties with them. I experimented then with pawls cut from flat clock spring but found that they either broke, due to excessive hardness, or that tempering left the steel soft so that they just wore away.

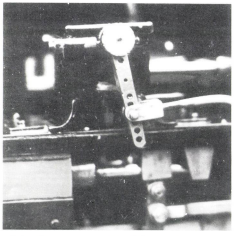
Just at this time a "Post Bag" article on Schrader springs appeared in the 20 June 1986 UK *Model Engineer*, by J.H Gladden. I made a pair; their reliability has been 100%, so *Hardwicke* has smaller versions of Schrader springs. Shorter and smaller in diameter, the design is nonetheless the same. Since the lubricator is hidden beneath the front buffer beam, a photograph of *Rail Motor*'s is included below and if fig. 4 is studied, their operation should be clear.

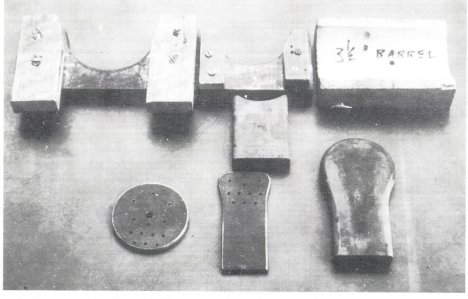
Each has a sleeve, compression spring and plunger. Sleeves are drilled and reamed within about 1/32" of full length. Small springs — I find cigarette lighter springs good — were cut to about half the sleeve hole length, while silver steel plungers about 3/4" length had spring spigots turned on one end while the other was filed approximately 45 degrees. Hardening and tempering the plungers was less delicate than the clock spring and certainly has been successful.


Front of Hardwicke. Lubricator tank, drive arm and check valve are visible below the buffer beam.

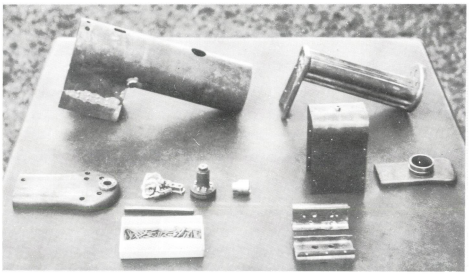
Crosshead pump

Though I prefer injectors for boiler feed, the small boiler on Hardwicke encouraged me to build the crosshead pump. It is tucked inside the space between the right frame and crosshead in a very confined location. Construction was simple: my main concern lay with maintenance access. I have found that if the locomotive is rested on its right side the gland nut is accessible. The pump has done all asked of it. With Teflon packing, the nut was tightened then slackened about a quarter turn to allow for expansion of the Teflon; it appears quite satisfactory in service.

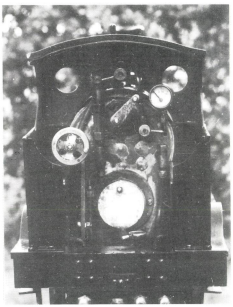

Schrader springs on Rail Motor's lubricator. The vertical spring is hidden behind the drive arm.



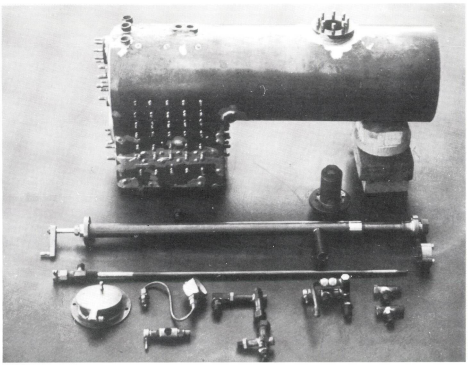
Boiler formers. Top left: Rail Motor throatplate. Top centre: Hardwicke's throatplate (two pieces). Bottom left: front tubeplate. Bottom centre: firebox front and back plates. Bottom right: backhead.



Boiler plates. Throatplate and firebox tubeplate jobs are done.



***Hardwicke**'s footplate showing off the completed boiler backhead.*



The boiler almost ready for steaming. Firebox stays are screwed from the inside, trimmed, dollied gently over and caulked with 60/40 soft solder. Regulator, firehole door and other boiler fittings are lying in front.

The pump is as LBSC designed it, with $\frac{5}{32}$" stainless steel ram (1$\frac{1}{2}$" stroke), $\frac{5}{32}$" reamed gland and $\frac{7}{32}$" bore. A screw-type by-pass valve on the cab floor has to be opened half a turn on continuous runs so the boiler is not flooded. All in all, it is most satisfactory — so the injector, which is awkward to use anyway, is superfluous on the run.

Boiler

Redesign of the boiler to AMBSC standards called for: provision of bushes for all fittings and the two longitudinal stays, substitution of $\frac{5}{32}$" by 40 for $\frac{1}{8}$" by 5BA threads, firebox stays at closer spacings, allocation of an individual bush for the pressure gauge, replacement of the Z type girder stays with thicker H pattern ones, manufacture of deeper plate flanges as per AMBSC, and inclusion of the (optional) fusible plug in the firebox crown. Plate gauges were acceptable — the main change was to twelve gauge from ten for the backhead — but the thirteen gauge smokebox tubeplate was made from fourteen gauge (no thirteen gauge is now available) as were the throatplate and firebox tubeplate. Otherwise, plates are sixteen gauge.

It seems that builders of copper boilers follow different stages of assembly. So, many readers will be interested in the sequence followed for the *Jumbo*. Eight operations were needed. Before each, the parts were cleaned in battery acid pickle, washed off in warm water, fluxed, riveted lightly together

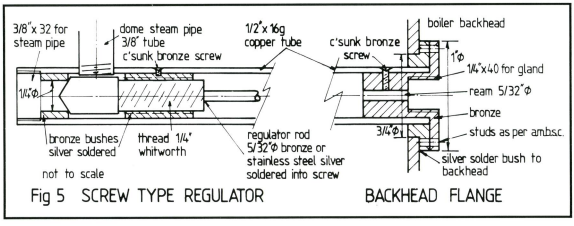


Fig 5 SCREW TYPE REGULATOR BACKHEAD FLANGE

Table 1. Boiler construction sequence

Step	Assembly sequence	Assembly hints
1	Tubes and flues to firebox tubeplate	Use Tobin bronze. Glass wool insulation is placed in tubes to prevent overheating
2	Throatplate to barrel and outer wrapper butt-jointed extensions	Use 235 silver solder
3	Firebox wrapper to firebox tubeplate; girder stays and fusible plug bush to firebox crown	Use 235 silver solder
4	Backplate and firehole ring to firebox wrapper	Use 235 silver solder
5	Girder stays to outer wrapper	Use 235 silver solder
6	Backhead to outer wrapper plus bushes for regulator, longitudinal stays, clacks and bottom water gauge, firehole reinforcing ring and turret, pressure gauge and top water gauge bushes	Use 245 silver solder
7	Foundation ring, bushes for safety valves, dome and blowdown and rear boiler supports	Use 245 silver solder
8	Front tubeplate with longitudinal stay and steam pipe bushes	Use 245 silver solder

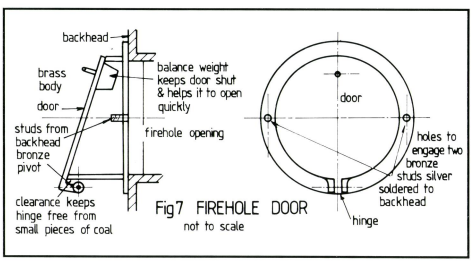
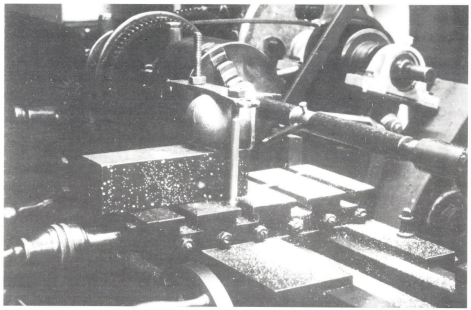


Fig7 FIREHOLE DOOR
not to scale



Fly-cutting the dome's base in the lathe using the line-boring technique.

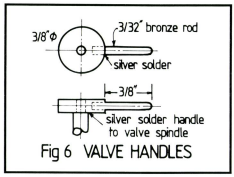


Fig 6 VALVE HANDLES

with 5/32" copper rivets (except for tube and bushes) and cleaned at rivet locations with metho-dipped cloth then re-fluxed. (See table 1.) After the job had cooled completely it was pickled for approximately thirty minutes, washed in water, checked for flux residue and solder penetration. Then, if all was well, it was washed in warm, soapy water and left to soak overnight in clean water to remove any remaining inaccessible flux.

Hardwicke's boiler is 3½" diameter with a roundtop firebox 17/8" by 3⅛". Overall length is 11¼". There are nine ⅜" diameter tubes and two ¾" diameter flues. A 2" deep firebox ensures plenty of steam and plenty of action at the wheels. Char is used for fuel.

Boiler Fittings

A simple screw regulator was designed to suit. As can be seen from fig. 5, the body is inserted through the backhead while thick-walled copper tube was employed for the steam pipe. Half a turn is full regulator. Opening of the valve is progressive; not sudden, it does not leak and it is neither slack nor tight in operation.

The two safety valves are hidden beneath a Ramsbottom style cover. Both are set to 80 pounds per square inch. Their design is the simple, yet very effective plain ball on a seat valve which LBSC used to recommend. There is no leakage and they always seat if made with moderate care. I use D bits to obtain flat seats.

The dome and safety valve casing were flycut with the parts bolted to the lathe saddle. I treated the chimney base in similar fashion. More time elapsed setting up than cutting.

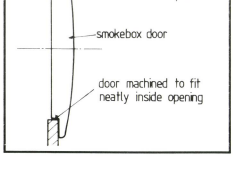
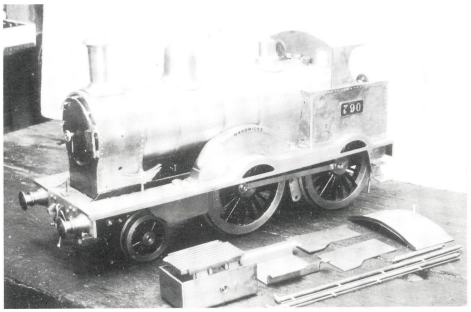


Fig 8 SMOKEBOX DOOR

The results more than justified the effort. A home-made between-centres flycutter shown in the photograph was made for the job.

Two features that are not prototypical are the handles on valve wheels and the drop down firehole door illustrated in figures 6 and 7. These were modified for ease of driving. Advantages of the tails on the handles are quick opening, visual evidence of the closed position and the ability to open and close extremely hot valves without resorting to a rag or gloves. Gloves are clumsy at the best of times and certainly are not suitable for this size of locomotive.

Since I am left-handed, the swing doors favoured by many, including LBSC, are a nuisance to me. Drop-down doors do not mind which hand feeds the fire and cannot swing back to burn fingers. Gravity keeps the door shut and open — a simple movement with the pricker opens it and there is no catch to unclip or clip. It is easy to close too. The door is mounted on a fabricated brass ring held against the firehole by two 7BA bronze studs attached to the boiler during its construction.



Hardwicke nearing completion with grate, ashpan, cab plates and boiler handrails alongside.

Smokebox

As mentioned earlier, the steam chest cover is also the smokebox floor. For ease of removal, and to maintain the inside cylinders and motion, it had to be simple to remove, and would be best if never removed from the boiler. Consequently, the boiler and smokebox detach as one unit.

Brass sheet was fabricated and silver soldered. Firstly, a ½" wide strip was silver soldered into a ring that would slide extremely tightly on to the boiler tube. Next, I cut out front and rear plates that fitted neatly between the frames and against the front and rear of the steam chest. Then the wrapper was cut to size — a piece of string over the outside of the front plate determined its length — and annealed for easy bending. Before proceeding with silver soldering it was necessary to turn the door and make its hinge because it was going to be silver soldered too. The hinge was fabricated from ⅛" brass rod and 1/16" brass plate. 3/64" brass rivets were fitted to the now U-shaped wrapper in two rows, using the method of countersinking inside to file flush (described earlier for the tender side plates). Careful drilling with a hand brace retained regular spacing of holes in the curve.

For assembly, ½" lengths of ½" by ½" brass angle were riveted on to the front plate to hold the wrapper. Rivets were first annealed and the holes countersunk so that they too could be filed flush. The rear wrapper was held with iron wire for silver soldering. The front was riveted to the wrapper via the short pieces of angle. Four hex screws, two each side, hold the smokebox to the steam chest. Pre-drilling these was an error — two had to be filled in and re-drilled because they were too high. It was silver soldered and the unnecessary rivet heads were filed flush after this.

Thin glass wool matting, which looks like cloth, lags the boiler. The brass cladding fits flush with the smokebox wrapper to give a prototypical appearance. Incidentally, in my opinion, wrapping the cleading is the most difficult task of boilermaking — it took me a long time! Cutting the holes for the dome and safety valve openings makes the sheet want to flatten out instead of curve — it is a pain!

Though I had pre-marked the centre for the chimney with a centre pop, I carefully remeasured it before drilling and filing for the chimney liner. The chimney was pressed firmly on to the fabricated brass liner and silver soldered. Due to the cramped interior of the smokebox, it is not bell-mouthed to allow it to clear the superheater wet header. Two 8BA countersunk screws hidden by the chimney keep it in place. Access to the superheater is made easy.

Air leaks in smokeboxes prevent locomotives holding steam pressure on the run. Leaks through the door can almost be prevented by machining a step in the door as described in fig. 8. I machined too much off, so the door is flat but I attached a copper ring inside to form the step. With this, the actual seal is the fit of the door inside the smokebox front — not on the outside plate. *Hardwicke*'s dart hardly needs tightening for the door to seal.

Grate and ashpan

I had stainless steel plate given to me. It is ideal for ashpans. A dump pin drops the grate and ashpan as one. The grate sits on the ashpan and is held up by four pieces of sheet about ½" wide acting as legs that wedge into the grate spacings. Some domestic copper

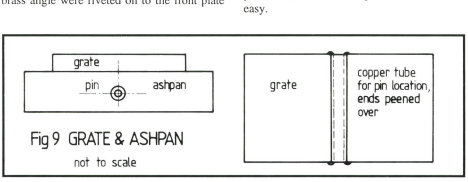
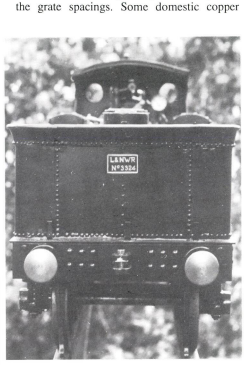


Fig 9 GRATE & ASHPAN
not to scale



Tender number plate.

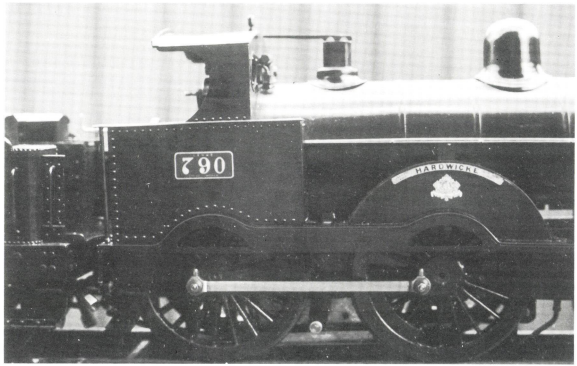
water tube offcut was used to locate the pin. It was forced through two holes in the ashpan sides and expanded slightly at the ends with a ball pein hammer. This is simple yet effective — see fig. 9.

Platework

Provision of maintenance access to the inside cylinders and motion is the Achilles heel of all such designs. Only by making boiler and smokebox removal as easy as possible will problems be minimized. I have already explained how the boiler and smokebox are, to all intents and purposes, one unit.

Eight sections make up the platework. Most holding screws are countersunk, two are hexagon headed. It only takes a few minutes to remove the twenty screws and/or plates as six parts. The rear driving wheels intrude into the cab sides, so each side has an inverted U space which sits over a wheel. The verticals at the footplate side can be removed if required but remain part of the cab sides for dismantling. The cab has six parts: roof, spectacle plate and two sides consisting of two parts each. These sides rest on, and are screwed to, the running boards which stretch the full length of the frames. Ahead of the leading splashers are underslung sandboxes (dummies) which are permanently attached. Two marker lamps are mounted at the front. One is a dummy, the other has provision to be a headlight — bulb and wires can be fitted.

Construction of the splashers started with shaping wooden formers to create the curves. Each side has an inner, large coupled wheel splasher and two outer, lower ones for coupling rod clearance. As on the tender and smokebox, the brass was annealed in "copper boiler making fashion" so it would bend smoothly and — best of all — stay in shape. Riveting with brass angle ¼" by ¼" was needed only on the flat sections. The heads were filed flush later. Elsewhere, curved sheets were sweated to verticals and excess solder was filed away. The major disadvantage of bending soft (annealed) brass is that if there is riveting, much care is essential to prevent marking the surface with accidental hammer blows. I prefer to bend it when soft rather than hard — there is no risk of cracking — so it comes out perfectly to the desired shape.



Number plate and nameplate.

Technical particulars:

	Full-size	3½" gauge
Overall length:	46'10.75"	2'10½"
Cylinders, two inside (bore/stroke):	17" x 24"	1⅛" x 1½"
Motion:	Allan link; slide valves	Allan link; slide valves
Boiler pressure:	150lbs per sq. in.	80lbs per sq. in.
Grate area:	17.1 sq.ft.	7 sq.in.
Weight:	60½ tons	Loco: 34lbs Tender: 16 lbs
Coal:	4 tons	0.75lb.
Water capacity:	1800 gallons	½ gallon

Finished curves were very pleasing when complete.

I can claim little credit for the nameplates and number plates which really finish off the appearance. The originals were photographed at York's National Rail Museum. My brother, John, drew the plates on to the largest format he could using the photographs as a guide. They were photographically reduced and then etched into brass plate. Each plate is precise and realistic. All I did was cut them from the plate (very brittle stuff by the way), file the edges accurately and sweat them on to countersunk 8BA screws prior to painting. Enamel paint was fine. After a day it was cut back with a razor blade to reveal the brass on the raised surfaces. A few days later when the paint had hardened, the brass surfaces were polished with Silvo® which is finer and therefore less abrasive than Brasso®. The crests on the splashes are decals obtained from Reeves of Birmingham, England.

Conclusion

Construction of *Hardwicke* gave me much pleasure. If these notes on the locomotive and its construction inspire even just one person to undertake a locomotive he or she likes, then I will feel well pleased. Perhaps, too, you will find something I've written is a "valuable tip". My knowledge — and I am not an expert builder, just enthusiastic! — has been gained from reading, listening to others and asking advice. That, when it is all said and done, is why I have written this article.

The *Hardwicke* of 1874

The LNWR built the *Precedent* class of simple 2-4-0s at its Crewe works between 1874 and 1882. Francis Webb was Locomotive Superintendent at the time. The *Precedents* owed much in design to Ramsbottom's 1866 2-4-0s. Webb's 2-4-0s came to be known as *Jumbos* in 1882 after an elephant at the London zoo: "Jumbo" was to be sold to the Barnum Circus in America and the consequent public outcry resulted in the *Precedents*, largest LNWR express passenger engines of the time, becoming known as *Jumbos*. Webb rebuilt the class and other 2-4-0 classes between 1891 and 1895 into renewed *Precedents* with thicker frames, new boilers (higher working pressure) and modernized smoke-box doors. At the end of rebuilding, the class numbered 166. In this era, the LNWR trains were the best in the country. Time-keeping was superb. The locomotives were all black — the famous blackberry black kept in resplendent condition to haul the spilt-milk-and-chocolate carriages. The LNWR was known as "The Premier Line".

No. 790 *Hardwicke*, like the others, had a stylish brass name plate on the leading splasher announcing that it was built at Crewe in 1873 (finished in 1874). *Hardwicke* is preserved at the UK's National Railway Museum, York. *Snowden* was the last withdrawn from revenue service, in 1934. Remarkably, *Jumbos* were used as main line pilots until 1927 on the then LMS. *Hardwicke*, the only preserved example, was restored to steam for the 1975 Stockton and Darlington cavalcade at Shildon. It was also steamed in 1980 for the Rainhill trials re-enactment, which I was fortunate enough to witness.

Hardwicke ran racing trains 19 times from Crewe to Carlisle as well as three times from Euston (London) to Crewe during the 34 nights of accelerated timing in 1895. No other locomotive from any other company ran as frequently. The 141 miles from Crewe to Carlisle was the most steeply graded section of either line to Scotland — 31½ miles from Carnforth to Shap Summit was an average of 1 in 188 in 1895. Some 2.98 times the locomotive's own weight was hauled on the night of 22, 23 August in 126 minutes to Carlisle from Crewe. Coal was stacked high on the tender for this run, with the locomotive driven all out. The average speed of 67.2 mph was the highest of any run during the 34 days and was the deciding factor in West Coast victory. This was despite a longer track mileage from Euston to Aberdeen than Kings Cross via York and Edinburgh to Aberdeen. O. S. Nock carefully calculated the speeds of all locomotives involved. Although *Hardwicke* must have run very fast downhill from Shap to Carlisle — up to 90 miles per hour — the loco averaged 62.4 mph up the 1 in 188. This is a remarkable record for 1895 with saturated steam and short travel valves!

The author at the regulator on the QSMEE's elevated track extension, Brisbane.

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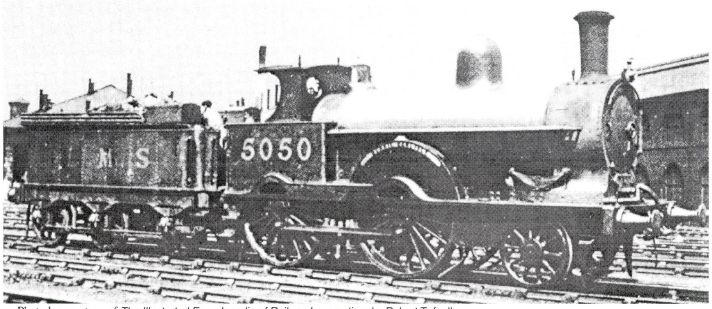


Photo by courtesy of *The Illustrated Encyclopedia of Railway Locomotives* by Robert Tufnell

Steam Chest

with Dave Harper

Hi there Steamies, and welcome to another collection of steamobilia!

Following on from last issue, I'll start with another gem from Burgh's *Modern Marine Engineering* of 1872.

For new readers, I had the opportunity to copy large chunks of this very rare and valuable book some while ago. The value of the book lies in the fact that it covers a brief period of marine engineering history when many bizarre types of steam engines were built, all of which became redundant with the evolution of the triple expansion engine around 1890.

As a result, all of these odd-ball engines vanished in short order, and to find all this information on them is a real windfall for anyone interested in the history of the steam engine.

The main type of engine that is remembered from this period is the trunk engine. An example of one of these was salvaged from a wreck off Western Australia in recent years, and caused considerable interest.

As I delved further into Burgh, it became apparent that trunk engines ain't trunk engines, to coin a phrase... there are single-trunk engines, double-trunk engines and return action air-pump trunk engines!

So, to start off with I've selected the drawings of a set of double-trunk 500hp engines built for HMS *Arethusa* by Messrs John Penn and Son of Greenwich, which is on the River Thames near (now part of) London.

As will be seen from the main drawing, the trunk consists of a large tube which passes right through the piston and cylinder. The object of this is to enable the connecting rod to be attached in line with the piston, doing away with the traditional piston rod and crosshead.

The trunk in effect acts as a crosshead guide, and has to be of a large enough diameter to allow for the angular movement of the connecting rod when the crank is at right angles, i.e., at mid-stroke.

Consequently, this whole tube and piston assembly moved together, and instead of the stuffing box around the piston rod there were huge glands around the trunk tube to keep the steam in.

The whole idea was to make the engine shorter so that it would fit across the bottom of the hull below the waterline as required by their Lordships at the Admiralty.

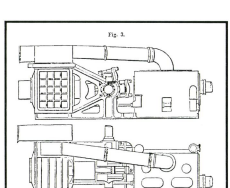


Fig. 3.

MESSRS. PENN'S MODERN HORIZONTAL CONDENSING DOUBLE TRUNK-CYLINDER ENGINE ARETHUSA.

The small drawing fig 3 gives a good idea of the whole layout of the engines.

The disadvantage of this arrangement, as was well realized by contemporary engineers, was the heat losses through the trunk plus the difficulty of sealing the gland around the trunk at both ends of the cylinder.

These inefficiencies were accepted as the penalty for making the engines more compact.

The scale of the problem becomes apparent when you realize the sheer size of these engines: cylinder bore 7ft 2½ins, trunk dia 2ft 9ins, stroke 3ft 6ins, length of con rod 10ft 3ins. The piston was 7¾ ins thick!

Incidentally, one of the reasons for the huge scale of these engines was that boiler pressures were limited to around 25psi. I've only recently read that the reason for this was not technical, as much higher pressures were in use for land-based engines.

It was because the naval inspectorate was many years behind the times and refused to allow higher pressures for safety reasons. It was not until the legislation was changed in the 1880s that marine engineers were permitted to increase boiler pressures, which then of course allowed compounding to be used. In short order, the triple-expansion engine evolved and made all these weird engines into dinosaurs.

Back to our dinosaur: the connection of the crosshead pin is attained by bolts and nuts passing through projections cast with the piston and front trunk. The back trunk is a separate casting secured by studs and nuts.

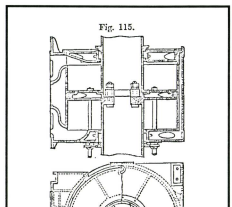


Fig. 115.

MESSRS. PENN'S CYLINDER AND DOUBLE TRUNK PISTON.

This is shown well in the small diagram fig 115.

The main frames were cast iron and the cranks were counterbalanced.

The slide valves were of the equilibrium double-ported type. A packing ring on the back of the valve excluded much of the area of the valve from the steam pressure, thus reducing friction. The recess at the back of the valve had a connection to the condenser, thus reducing the pressure on that part of the valve even more.

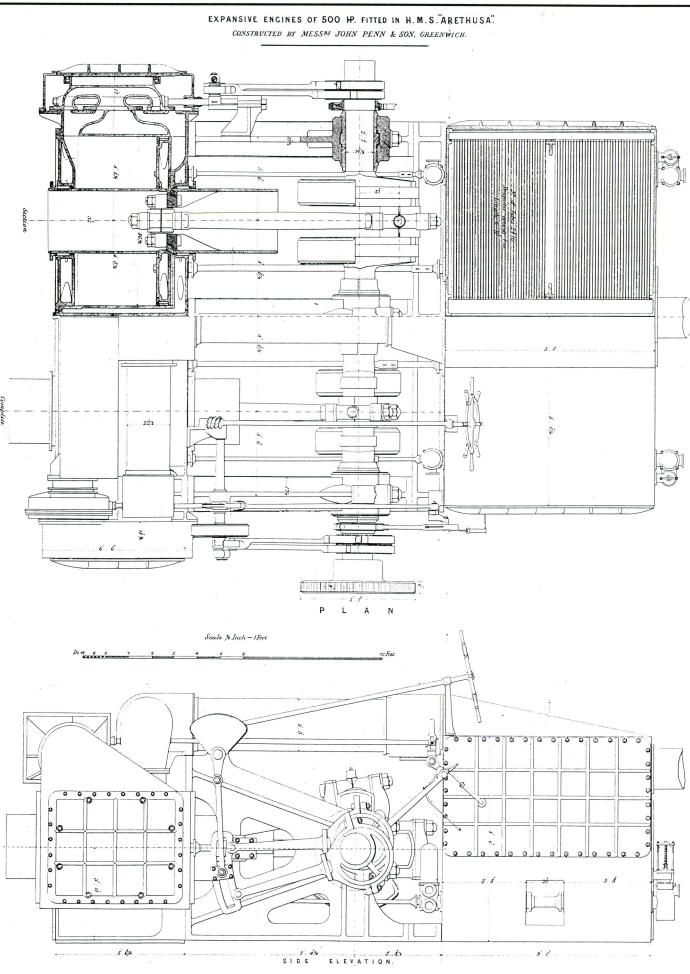
The valves were operated through a Stephenson's link style reversing gear. The crankshaft appears to be about 14 inches diameter, which makes the eccentrics something over two feet across!

The cylinders were fitted with Penn's patent relief valves, which appear to have been held closed by steam pressure. To quote from the text:

"According to my invention, I apply, instead of weights and springs, the pressure of the steam to keep the escape or relief valves in their seats. For this purpose I place the valves, enclosed in cases, on any convenient part of the cylinders sufficiently high for any water to pass by means of pipes into a separator in the main steam pipe of the engine... It will be seen that the valves are kept in their seat by the difference between the pressure of steam in the main steam pipe and the cylinder, and also in consequence of the difference in area between the outer and inner faces of the valve.

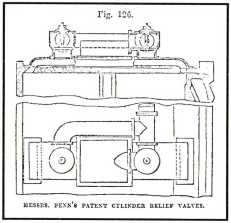
In this arrangement there is so little weight tending to keep the valve on its seat, that it will frequently open in consequence of the compression of steam in working expansively by the link motion, or arising from suddenly reversing the engines, and no strain can come on to any part of the machinery beyond that resulting from the pressure of the steam."

It goes on to say that the escape of steam into the engine room is avoided and the dan-


EXPANSIVE ENGINES OF 500 HP. FITTED IN H.M.S. "ARETHUSA"
CONSTRUCTED BY MESSRS JOHN PENN & SON, GREENWICH.
Centre line
PLAN
Scale ½ Inch = 1 Foot
SIDE ELEVATION.

ger of scalding removed. The steam is not wasted either as it goes straight back into the main steam pipe!

Fig 126 illustrates the relief valves.



The layout of the book made compiling these notes difficult, as the text treats each component of the engines separately. Thus the description of each engine is scattered in bits throughout the text! The language used is also quaint to say the least, by today's standards, so please accept any strange wording as taken from the text and not my usual style! *...we hadn't noticed Dave! - ed.*

More from the Sampson Collection

The pictures of Dave Sampson's little steam pumps in the March issue prompted a letter from Peter Lukey of Queensland. Peter told me he has a small Marsh simplex pump very like Dave Sampson's, set up as a display item in his office. The pump is mounted on a base which also acts as a water tank so it can be run on compressed air for demonstrations. This can be seen quite clearly in the photo.

Peter not only sent me some pictures of his pump, but also a copy of the original catalogue put out by IBC showing the range of pumps produced by Marsh. Peter's is the smallest made, having a 2½" bore steam cylinder, 1⅜" pump bore by 2" stroke. It pumped 160 gallons per hour and cost £6!

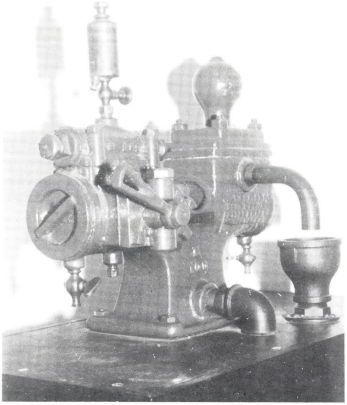
The range of pumps goes all the way up to a 10" and 6" bore x 12" stroke unit rated at 7300 gph and costing £65!

By comparison Dave Sampson's models, shown in the three photos on the right, have bores of ⅜" and ¼" and stroke of ⅜"! The pictures show two of the developments in Dave's series of models, as he refined and "prettied up" the design.

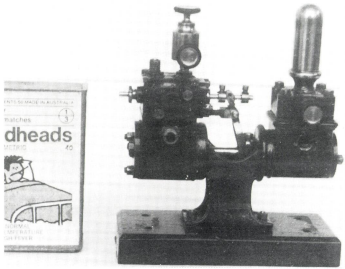
No castings are used in these models, all parts being fabricated.

To round out the column this time is another of Dave's miniatures, a compound high-speed engine based on a Robey design. It is non-reversing but has a flywheel governor. Bores are ¼" and ⅜" and stroke is 8mm! Dave couldn't quite remember the reason for this mixture of measurements, but he knew that it seemed a good idea at the time!

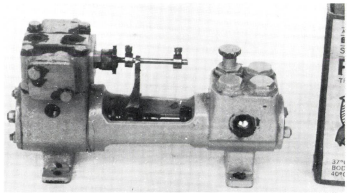
That's all for this time. Till next issue, happy steaming!



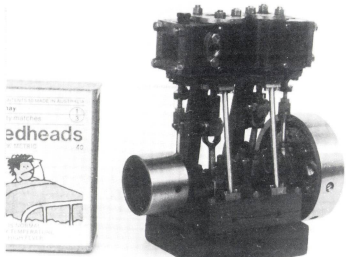
Peter Lukey's Marsh simplex pump



Dave Sampson's simplex pump.



Horizontal simplex pump, a later, simpler design.



Compound ¼" and ⅜" bore x 8mm stroke high-speed engine on Robey's design. Non-reversing, with a flywheel governor fitted.

Injector Testing — with a Boiler Simulator

Phillip T. Bellamy

With the publication of our first review on injectors and the parameters for their testing [AME Nov-Dec 1992, page 36], we mentioned that to keep the set-up fairly simple, we did not measure the steam consumption of the injector. Phillip Bellamy wrote to us from Switzerland to describe his "Boiler Simulator" or "Pressure Balance Device" for those who wish to know how to quantify the actual steam consumption of their injector.

Why test injectors? When one considers the price of commercial injectors, it is unreasonable to expect to be supplied with the results of a range of performance tests carried out on individual units.

Even if a simple test is carried out on each unit sold, as some manufacturers claim, it is unlikely that this information will be sufficiently comprehensive to allow confident application of a particular injector to a model engineering project. Testing injectors takes time and effort. However, the task of carrying out the tests will not only reward you with greater knowledge, but will also acquaint you with some of the good and bad habits that injectors can demonstrate. After a few test series have been completed, you will find that you can evaluate a good or bad injector quickly and easily, even without going through all of the test procedures every time.

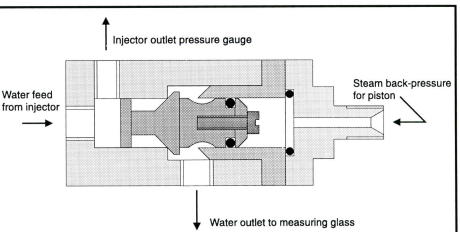
What characteristics do we test for? All tests done on injectors are related to the delivery performance of the unit. Consequently, the tests are organized to give information on:

- the degree of vacuum developed in the suction line (relates to the lifting ability of the injector), and
- the water delivery volume relative to various steam pressures and feed water temperatures (relates to the capacity of the injector).

The boiler simulator

A boiler simulator is a device which can be connected to an injector to allow the injector to operate as if feeding a boiler. The simulator is designed to accept water from the injector and discharge it through a built-in port from which the volume of water delivered can be measured. A boiler simulator requires steam for its operation, as does the injector to be tested. Therefore an independent boiler is required to provide this source of steam. A typical boiler simulator is shown in the sketch below.

Why test using a boiler simulator, rather than a boiler direct? It is important in any testing programme that operating conditions that can be controlled are maintained at constant levels, so that performance characteristics can be fairly compared. When testing injectors connected directly to the boiler, it will be found, when making flow tests, that the water feed to the boiler will become sufficiently high to reduce the steam pressure. The consequence is an unwanted change in the injector operation. As the purpose of testing is to determine the characteristics under steady conditions, such an arrangement is unsatisfactory.



BOILER SIMULATOR (sectional view)

Equipment requirements

The boiler needs to be capable of producing a steady volume of steam for the duration of the test procedure. Further equipment is also required:

- Two pressure gauges, approximately 60 to 75mm diameter and calibrated to cover the working range, or say 0 to 150 psi (0 - 1034kPa).
- One boiler water-level gauge.
- One vacuum gauge, 60 to 75 mm diameter.
- One metal container to be used as a feed-water reservoir.
- One metal container to be used as a catch tank for the injector overflow.
- Two steam valves.
- One stop cock.
- One measuring cylinder, flask or graduated device.
- One thermometer, preferably mercury in glass (such as used in laboratories), approximately 250 to 300mm long and calibrated 0 to 100°C.
- One stopwatch.
- Appropriate tubing and fittings.

Equipment assembly

A schematic diagram of the test equipment layout is shown on the following page. The pressure gauges are installed to allow observation of the boiler pressure and the feed water pressure at the boiler simulator.

The vacuum gauge allows recording of the injector suction, or rather, the ability of the ejector action of the injector to pump water. This means that when starting there is not just air to be removed, but water vapour as well. Neither the air nor the water vapour will condense the steam jet, so adequate provision has to be made in the passage ways for the steam to escape and not generate any back pressure.

The thermometer is used to obtain temperatures of both the feed water at the reservoir and the delivered water in the measuring container.

The stop watch is used to time the interval of each test. When assembling the apparatus, take care to place the catch tank for the injector overflow in a position remote from the feed water storage to avoid heating the feed water.

Arrange the injector in a position which will provide a suction lift of approximately 125 to 150mm.

The test procedure

To obtain reiable results, it will be necessary to stabilize the feed water temperature at close to ambient temperature, say 15 or 20° C.

Begin with boiler pressure at 20 psi (137.9kPa) and open the steam cock to put steam pressure on the simulator. Apply steam to the injector and note the vacuum reading on the vacuum gauge. Using the stop watch, measure the output (if any) from the injector for one minute. If no discharge, note "nil" and further, note if the overflow is dripping, and/or the discharge is "dry". This procedure should then be repeated for boiler pressures at 5psi (34.5kPa) increments until the highest pressure is determined at which the injector feeds "dry" and also the pressure at which the injector stops feeding. At each test, note the inlet and outlet water temperatures. Having completed this series of tests, the injector should be operated at the maximum pressure at which it will feed "dry".

Simultaneously, commence heating the feed water, noting the temperature at which the injector ceases operation.

Immediately start to cool the feed water and note the temperature at which the injector recommences operation.

For the next stage, the steam pressure should be reduced incrementally and the ability of the injector to feed "dry" can be evaluated against rising feed water temperatures. Finally, using feed water at ambient temperature.

Increase the lift between the injector inlet and the surface of the feed water and note at what height the injector ceases lifting or 1.5 metres, whichever is first.

Summary of readings

Tabulate or plot all of the results under these headings:

Feed water temperature; boiler pressure; injector suction; simulator steam pressure; discharge water temperature; discharge water volume for one minute; boiler pressure maximum for "dry" injection; boiler pressure maximum for no injection; feed water maximum temperature for reliable feed; feed water maximum temperature vs decreasing boiler pressure for "dry" feed; maximum suction lift of injector (or 1.5 metres).

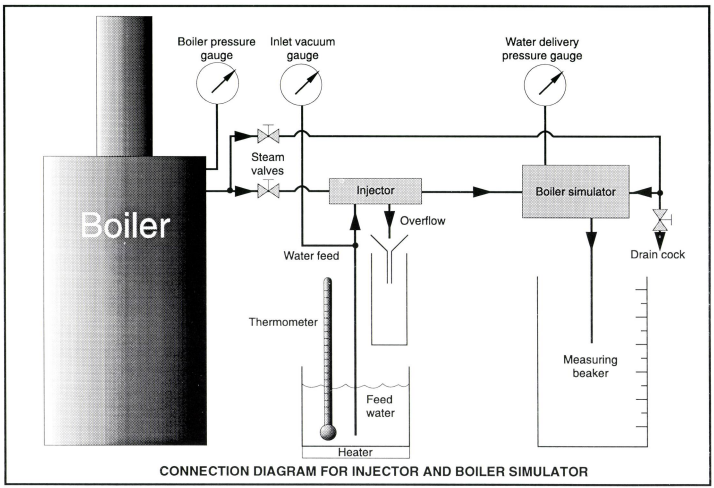
What is the use of all this information? Once you have assembled the data from these tests, you will have a very good profile of the operating characteristics of your injector. The highest pressure at which the injector will feed "dry" should be 15 psi (103.4kPa) higher than the operating pressure envisaged for the model project. The range of pressure over which the injector feeds "dry" should be approximately 90 psi (620.5kPa). That is, if the model operates at 100 psi (689.5 kPa), the injector should feed "dry" over the range 25 psi to 115 psi (172.3kPa to 792.9kPa).

The volume of feed water the injector delivers can be assessed against the requirements of your model. In general terms, an injector of suitable delivery size will be considered adequate if it will lift water approximately one metre and will feed "dry" to your requirements with feed water at 35° C.

Conclusion

One thing becomes clear when these tests are understood. The limitation on the upper temperatures of the feed water explains why there are more feed problems on tank locomotives than on those with tenders. My solution to the problem has been to use the water in the loco tank as ballast only, and to draw feed water from a large tank in the driving truck.

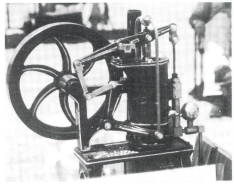
The acid test for any injector is actually working on a locomotive under all extremes of conditions. This is not always so easy to simulate on a test rig. However, with some methodical testing, as described above, most aspects are covered and the chance of success on the track should be about 99%. The one parameter which could be troublesome is atmospheric pressure, as encountered on tracks at high altitude.



CONNECTION DIAGRAM FOR INJECTOR AND BOILER SIMULATOR

Maritime Matters

with Leigh Adams

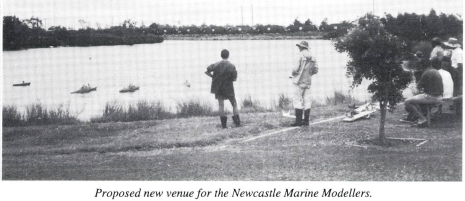


The Newcastle Water Festival wasn't just about boating! This ¼ scale 1890 Ericsson ***Reeco*** *hot air pumping engine was one of three model engines on display built by Reg Ingold.*

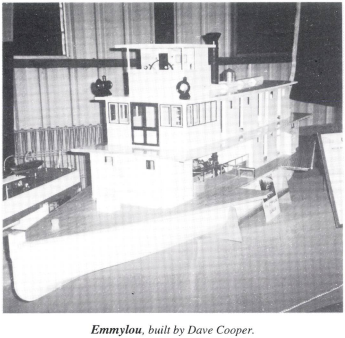
Club regattas are being held regularly around NSW and I endeavour to attend all of them. New models are being launched and displayed all the time. On a recent trip to Newcastle, I met up with Bill Elbourne and members of the Newcastle Marine Modellers who were giving a new pond the once-over — their present venue is badly weeding up. The club is working closely with the local council to develop the new model boat pond. It is at an ideal site — adjacent to football and cricket playing fields — a captive audience! With established gardens, toilets and car park this venue has great potential. The large open water will look spectacular with twenty or thirty model boats navigating their way around.

The Maritime Model Club of NSW displays regularly at the St Ives Show. The club has received several awards for displays of outstanding quality. Two new models were put on show this year. Dave Couper has been building the paddle wheeler *Emmylou* for some years and although not quite finished, is most impressive in both size and quality of finish. Attention to detail is fantastic, all the cabins are fully furnished including books in bookcases, lights and even miniature cans of Coca Cola on the tables! Another new model is the *Frans W* built by Noel Chippindale. This model came to life when Noel purchased a set of plans and, after discussing them with fellow members, decided to increase the plan size 1½ times. The finished result of 1220mm (48inches) long is a good size. *Frans W* looks impressive both on and off the water.

The Newcastle Water Festival, held each year, attracted maritime modellers from NSW, QLD and the ACT. The regatta was held at Frog Pond — tug boats and naval ships dominated the water. The Newcastle Council drained, cleaned and filled the pond with fresh water for the weekend. The brilliant sunny weather and crystal clear water made ideal conditions for the submarines. The subs amazed the public by diving and surfacing at will. This is one of the most difficult facets of modelling submarines, very few modellers seem to get it right! A few have lost model subs when they lost control after the sub had submerged and took off — never to be seen again. Big crowds lined the edge of the pond



Proposed new venue for the Newcastle Marine Modellers.



Emmylou*, built by Dave Cooper.*

Frans W*, built by Noel Chippindale.*

Frog pond at Newcastle. 1/24 scale tugs were towing a dinghy around during the event.

A closer view of the 1/24 scale tugs that were towing the dinghy.

and the kids enjoyed rides in the dinghy towed by the model tug boats.

The Maritime Model Club interclub regatta was held at Narrabeen. This venue, developed and maintained by the club, was an ideal setting for what was a most successful day. Good weather, sixty model boats and a hundred modellers made this one of the best gatherings for some time! This purpose-built site is continuously being renovated and expanded, this year the guests were treated to new picnic tables. The extensions to the wharves provide good access to the water and plenty of room for mooring models.

More regattas are on the modelling calendar, so if you are interested in marine modelling take the time and visit your local club!

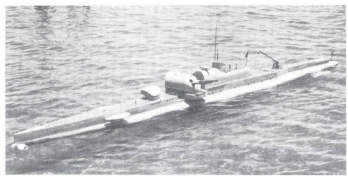
TF72 Regatta 1996

Task Force 72 — Regatta 96 — will be held over the weekend of the 7 and 8 December 1996. It coincides with the 55th Anniversary of the bombing of Pearl Harbour on 7 December 1941 — the start of the World War II in the Pacific. We'll try to avoid any air raids this time!

TF72 venue improvements

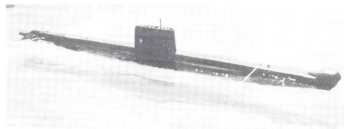
The venue at Wentworth Falls should be even more spectacular and user-friendly this year. The City of Blue Mountains Council have recently concreted a walkway for bikes and wheelchairs from the roadway to the weir wall and are presently installing new electric BBQs and more picnic tables. They have also discussed improving the water's edge for marine access by placing a timber or concrete edge along the foreshore. With support from the Council such as this, TF72 can be assured of using this venue on a regular basis and improve its standing with the Council and the local community.

A model tanker designed to train real tanker operators!



A French submarine model with deck cannon that fires blank rounds! As a coincidence, this photo was taken on the last day of the French nuclear tests!

*Left: HMAS **Vampire** built by Geoff Eastwood.*
Right: Anzac frigate built by Rus French. Both models are to 1/72 scale.



Oberon class submarine.

A "Primitive" Beam Engine

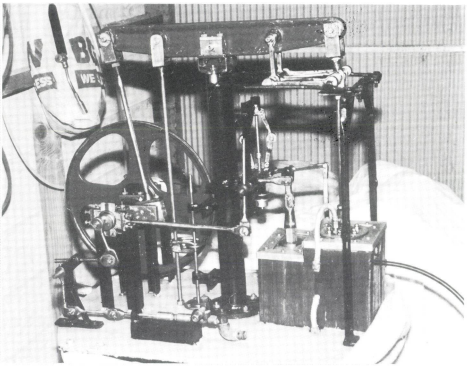
Story and photos by Bob Ellis

I call this a rotative, condensing, beam engine. It was built to illustrate the ideas of the "old" builders. Their low-tech era forced them to adopt more simplistic approaches to such problems as setting up machinery on foundations.

In effect, they placed the heavier components on stone- or brick-built beds, and then dragged them back and forth across the bed in order to rub the surfaces down to suit. No packing-up and grouting-in in those days!

They made the various connecting links etc., to suit — witness the house-built *Cornish* mine pumping engines of the 1700s where condenser pumps and mine water discharge chutes etc. appeared to be placed almost at random. On these engines, the beam itself was pivoted in the wall of the purpose-built engine house, making the engine house in effect part of the engine.

While most of the makers and the engines are now gone, at least one of these old Cornish firms still survives — Holman's of Cambourne — although they are now part of a compressed air conglomerate. But enough of history.



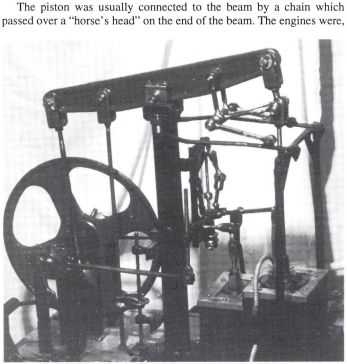
A general view of the "primitive" beam engine. The boiler feed pump is located at the lower left of the main column.

The beam

The engine is, where possible, fabricated from steel plate and strip.

The main beam trunnions, the crankshaft main bearings and the bottom-end bearing are all of solid brass, with conventional keeps of steel. These bearings were all made as top and bottom halves, drilled for bolt holes, and bolted together on an angle plate for boring in the lathe. The beam itself is made from ¼" steel plate, edge trimmed with ¼" x ½" steel strip welded on. The various pins and bushes pass through pads welded either side of the beam as necessary.

The piston was usually connected to the beam by a chain which passed over a "horse's head" on the end of the beam. The engines were, obviously, single acting — you can't push a chain!



The parallel link motion.

Cylinder and valve chest

The cylinder is machined from a piece of cast brass hollow bar; its finished bore is 2¼" diameter. The cylinder top cover is made from a galvanized malleable iron pipe flange, the screwed centre being utilized to carry the packing box assembly. The valve chest is also made from hollow brass bar, machined as necessary for steam ports etc., with a ¾" bore. It carries a brass piston valve complete with valve rings. A suitable top cover carries the packing box and valve rod guide.

The valve chest stands about 1" away from the cylinder, giving rather long steam pipes to the cylinder. Here the purists will say "most inefficient!" but then, the beam engine did precede the microchip by a couple of hundred years. Nevertheless, the clearance volume is 5% top and bottom.

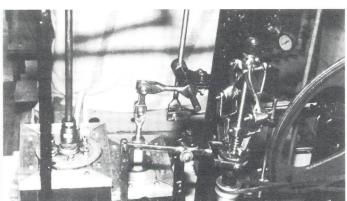
Crankshaft

The crankshaft is fully fabricated. The journals and crank pin are 9/16" diameter, the webs are made from 1¼" x ½" flat steel bar. The two webs were tack-welded together, match marked, and bored on the faceplate as one piece. The tacks were then ground off, the webs separated, and the pin and journals pressed in according to the match marks. A clock gauge (dial test indicator) was used for the final alignment of the journals. The 2⅜" throw of the crankshaft provides the 4¾" stroke, as the beam is centrally pivoted.

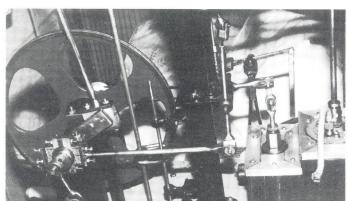
Valve linkage

The eccentric and strap use conventional construction methods. The eccentric is one piece steel, the strap is of brass — in two halves. The linkage between the eccentric and the steam valve allows full adjustment of the valve for length of travel and height in the chest. The eccentric is fully adjustable radially on the crankshaft. The valve has no lead and very little lap in order to achieve smooth running at slow revs.

The Watt parallel link motion is fabricated from 5/16" square steel bar suitably bushed at the end of each link. The linkage is tied back to the black steel frame at the cylinder end, which in turn is bolted to the base plate and to the beam column.



The governor and valve gear.



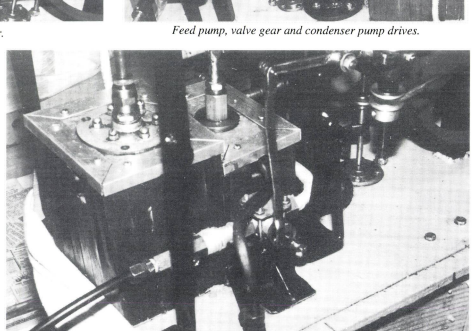
Feed pump, valve gear and condenser pump drives.

The engine dimensions	
Cylinder bore	2¼"
Piston stroke	4¾"
Min speed	20 revs/min
Cruising speed	50 revs/min
Overall height	960mm
Engine height above condenser	640mm

Flywheel

The flywheel is the only "as-is" item on the engine. It started life as a 14" diameter cast iron chain wheel. I merely removed the teeth, and bushed the bore to suit the crankshaft.

It occurs to me that many of us have considerable trouble finding suitable material for use as flywheels, in the larger sizes anyway. We often resort to things like cast aluminium V belt pulleys which, for appearance, fall a bit short of the mark. A far more appealing alternative is to use a readily available gate valve handwheel, and machine it as necessary. These wheels can be obtained up to 24" diameter. The larger ones are invariably cast iron. Some have S spokes, some have straight spokes. They would be obtainable from the larger engineer's suppliers.



The governor valve and linkage. Note the timber lagged cylinder and steam chest.

Feed pump

The boiler feed pump is 7/16" bore. It has an adjustable stroke of ¾" to 1¾", and is driven by an offset pin on the end of the crankshaft.

Governor

The governor is just another version of the Watt governor. It was designed to achieve a "primitive" appearance rather than technical perfection, while at the same time functioning as a working governor of the day. The rising governor sleeve is controlled by a compression spring above it on the drive shaft. The governor movement is transmitted to the governor valve via the governor fork and a rather long linkage system. The governor valve is a balanced butterfly working in a cylindrical bore having closed ends, with suitable bushing to carry the valve spindle, plus, of course, the necessary steam porting.

Condenser

The engine has a condenser, in keeping with beam engine tradition. In fact, the earlier beam engines worked on vacuum rather than steam pressure. The piston was returned to the top of its stroke by a counterweight on the other end of the beam, the counterweight being the pump rods reaching to the bottom of the mine shaft. Steam at little more than atmospheric pressure was led into the cylinder, often by a hand operated valve. When the cylinder was full, the valve was closed and a cold water spray turned on into the cylinder. This immediately condensed the steam, forming a vacuum and drawing the piston rapidly down to the bottom of the cylinder. This was the power stroke of the engine. A drain valve was then opened and the spray water and condensate allowed to flow out of the cylinder. These cylinders had no top covers. As the vacuum decayed the beam counterweight would return the piston back to the top of the stroke in readiness for another go. These early engines were non-rotative and were designed for lifting water out of the mines in a series of stages.

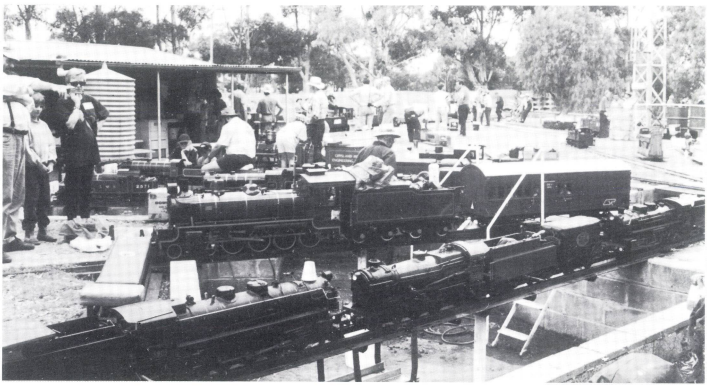
The condenser on my engine consists of two 1½" diameter x 8" long extended area copper tubes, (copper tubes squashed oval in the vice) lying at 30° angle in a tank of cold water, with a condensate pump pulling the condensate out from the lowest point. These tubes are connected to a common inlet and outlet. The condenser pump lies beneath the grey painted base of the engine. It is a piston pump of adjustable stroke, from ½" to 2" by 7/16" bore. It is driven by the beam-operated rod assembly seen between the crank con-rod and the beam pillar. The engine may be run either to atmosphere or to the condenser by the simple expedient of shutting the atmospheric exhaust valve.

Conclusion

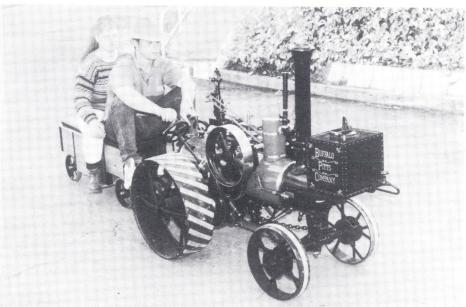
When running, the apparently conflicting movements of the various parts are fascinating to watch at slow speed. In this respect, they leave enclosed engines for dead!

The 40th AALS Convention

Story and photos by Brian Carter



Where the action starts: the turntable at Penfield.



John Lever's Buffalo Pitts traction engine tours the grounds.

The 40th anniversary of AALS conventions was celebrated in grand style with the host, the Penfield Model Engineers Society Inc., at their grounds in the Northern Adelaide suburb of Salisbury South Australia. It is traditionally the largest gathering of model engineers in Australia, and this year was no exception — there were 110 pre-registered items of model machinery! A few more models arrived during the convention period. The locomotive models comprised of four 3½" gauge, seventy-two 5" gauge and thirty-one 7¼" gauge. There were three road vehicles.

The organization

The Penfield Society are "old hands" at organizing conventions — this was their fourth! Unfortunately, for many months leading up to the convention, the society's future at the Salisbury site had been in doubt. Understandably, members were reluctant to expend time, effort and money on facilities that they might shortly lose. Despite the bad news, the

society beat the odds and put on a great event! Just prior to the convention, the society received the encouraging news that they may not have to move after all! This helped to raise spirits and enthusiasm as the convention date came closer.

The catering was excellent, every meal was wholesome and every meal was different! A splendid effort by the convention team under difficult circumstances.

The society is located on four acres of Department of Defense recreation reserve. The site consists of a half-acre boat pond, 1067 metres of 7¼" and 5" dual gauge ground level track and an elevated track with 260 metres of 5" and 3½" gauges. There is also special track for radio control cars. Traction and other miniature road vehicles have plenty of operating space.

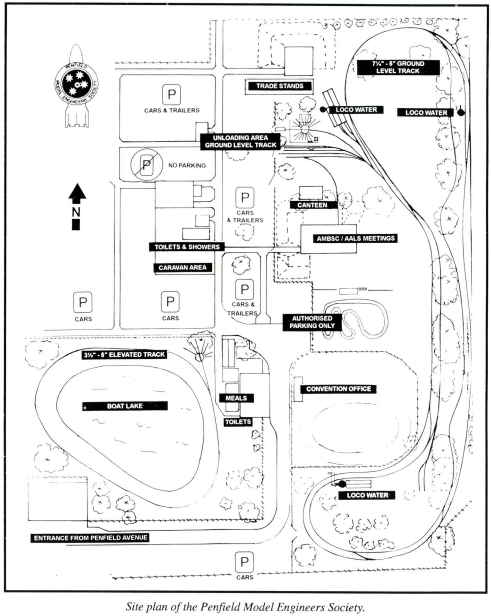
With an outdoor activity such as this the weather is always a concern, and this year was no exception. Fortunately it was mostly fine, Friday was warm and sunny, a Saturday afternoon shower put an end to plans for a night run. Light rain drifted in and out during Sunday. Monday was overcast but dry.

Commercial exhibitors

Wayne Roberts, LPR toolmakers, and Rodney Hudson were on hand to provide all the parts required to build the models. AME Retail — Les and Gayle Mouat — was on hand to provide the inspiration.

Inspiration

Many models were very inspiring: it is almost impossible to leave a convention without the urge to either finish a project or start one. I was no exception, since I returned home I was enthused enough to get my steam locomotive re-assembled and re-certified after a two year lay-off due to other commitments!



Site plan of the Penfield Model Engineers Society.

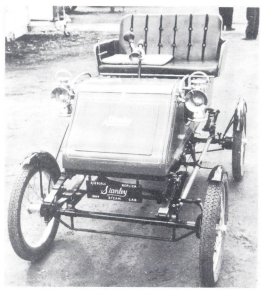
Road vehicles

It was pleasing to see some support for road steam vehicles. John Levers was there with his Buffalo Pitts traction engine — bright and shiny as usual! Mr. Lee scooted around the area with his undertype steam wagon.

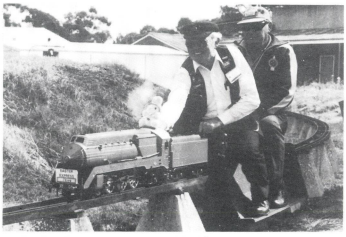
The surprise of the weekend was the appearance of a two-third size 1904 Stanley Steam car. Bert Francis has done a wonderful job on this model. The Tullamarine Society judges thought so too and awarded Francis with their Road Vehicle trophy.

The road vehicles attracted quite a bit of attention, many "railway" modellers were spotted looking into the "works" of the Buffalo Pitts and the wagon. Maybe we'll see a few more tracos as well as locos sometime in the future?

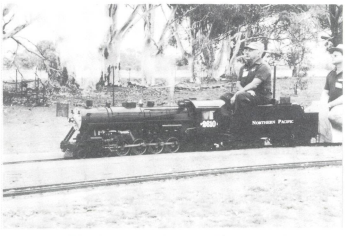
Mr. Lee's undertype steam wagon.



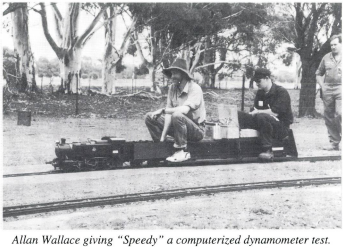
Bert Francis' Stanley steam car.



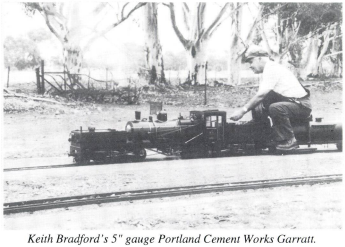
Geoffery Evelyn at the throttle of the 3½" gauge Easter Express.



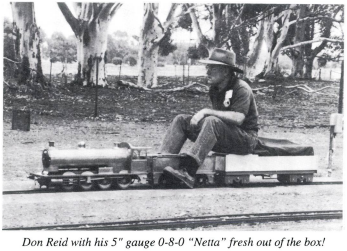
John Wakefield tries out his rebuilt 7¼" gauge 4-8-4.



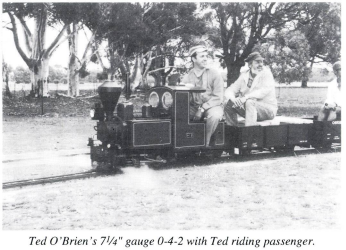
Allan Wallace giving "Speedy" a computerized dynamometer test.



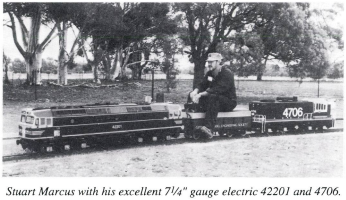
Keith Bradford's 5" gauge Portland Cement Works Garratt.



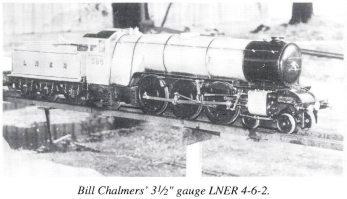
Don Reid with his 5" gauge 0-8-0 "Netta" fresh out of the box!



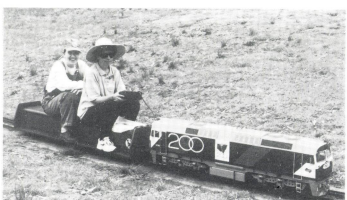
Ted O'Brien's 7¼" gauge 0-4-2 with Ted riding passenger.



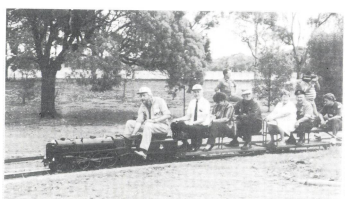
Stuart Marcus with his excellent 7¼" gauge electric 42201 and 4706.



Bill Chalmers' 3½" gauge LNER 4-6-2.

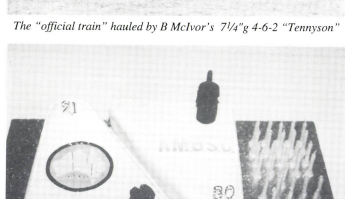


Susanne Carter driving AME's 42218.



The "official train" hauled by B McIvor's 7¼"g 4-6-2 "Tennyson"

The prizes, left to right: UK Southern Federation trophy; the Bolton trophy; AME under 25s award; The Tullamarine Trophy and the SSME trophy.



Happy Birthday!

Awards

The Sunday evening at each convention is the time when a few members of the model engineering fraternity are recognized for their contribution to the hobby.

The Sydney Society of Model Engineers award for the most popular locomotive at the convention as judged by the delegates went to John Lyas for his *Clishay* and log train of the Nullabor Logging Company.

The Bolton trophy, presented by E. & J. Winter, for the best Australian prototype locomotive was awarded to Ross Bishop-Wear for his Fowler narrow gauge cane locomotive.

The UK Southern Federation Trophy for a model engineer who has provided outstanding service to the hobby, and has a locomotive at the convention, was presented to Barry Glover.

This year Len Heaton retired as secretary of the AALS. To honour the service that Len had provided the hobby he was presented with a painting of a Queensland locomotive.

Although this year was the 40th annual (AALS) convention, the AALS celebrated its 21st birthday and the AMBSC celebrated its 30th birthday! Congratulations to those organizations — long may they continue. To celebrate in fine style a cake was ceremoniously cut and Champagne sipped. The birthday tune was gracefully played on the piano by Gwendlyn Evelyn.

AALS Matters

As Len Heaton retires from the role of AALS Secretary we welcome Frank Clark of Victoria as the incoming Secretary.

We welcome the Grandchester MLSA of Queensland as an AALS affiliated Model Engineering Society.

AME award

One of the special features of the convention for AME is the under 25s encouragement award. In last year's report I said that I was disappointed with the general lack of interest in the award — this year we had six entrants! All of them brought along extremely good models to show off their talents. It is always a pleasure to see younger members of the community taking up a hobby, especially model engineering.

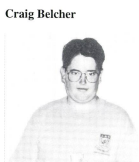
I would like to thank the Penfield society for arranging a tent to house some of the exhibits and to Ray Matthews for producing an excellent sign to point the way.

The under 25s encouragement award is exactly that. It is an award instigated to encourage the under 25s to have a go! It is not a contest, and there is no first prize in the usual sense. In fact, the first prize goes to the hobby, because there are valuable talents gaining experience in an exacting past-time.

The selection criteria is based on the age of the entrant and the skills relevant to age; the ambitiousness of the project; the workmanship of the project; the access to workshop materials; and the formal skills of the entrant.

Meet the U25s entrants

Craig Belcher



Craig is 15 years of age and attending a pre-apprenticeship Fitting and Machining TAFE course and helps out at the Castledare Miniature Railway of WA. Craig presented a single cylinder oscillating engine for compressed air operation. The main materials used are mild steel, silver steel and brass. Most of the model was machined in the lathe and milling machine with a small amount of hand filing to clean up the edges. The model was made with the guidance of the TAFE instructor.

Simon Huntington

Simon is a 24 year old machine tool fitter from South Australia. He is married with two children. Simon provided a variety of models for us to see his diverse interest in model engineering. His main entry is his 7¼" gauge *Heidi II* under construction. He has completed his tender and a four-wheel brake van.

Simon won a bronze medallion at TAFE so his company enrolled him in the Work Skill Australia competition: he won in south Australia, and came third in the national finals held at Sydney.

Simon is building up an extensive workshop at home, mainly by building new or repairing old machinery. He found some castings of a small horizontal stationary engine in a shed and without the aid of drawings managed to complete the model to run on compressed air.

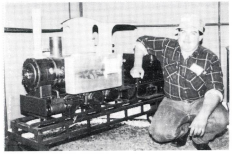
Michael Lyas

Michael, 11 years of age, is a Year six school student and frequents the Adelaide Miniature Steam Railway Society with his father, John. Michael entered a stationary steam engine project he is working on. His father supervised his workshop activities and showed him how to operate the machinery.

A problem was encountered with the imperial measurements of the plans. Michael had no idea what the numbers meant! He had to learn the imperial system before he could start. The project has been a fun learning experience. A combination of machine and hand tools was used to create the parts. Michael had to learn to read a micrometer. The project involve the use of brass and stainless steel components.

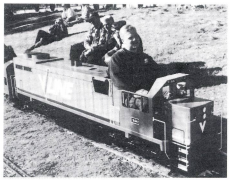
Andrew Matthews

Andrew, a 19 years of age second year apprentice toolmaker, is a member of the Roseworthy Railway Inc. SA. Andrew has been under the model engineering influence of his father, Ray, since he was about three years old. Andrew's entry is a 7¼" gauge freelance 0-4-0T loosely based on a German industrial design.



The loco has a 200mm diameter steel Briggs boiler with thirty eight 12.7mm diameter copper tubes. The side tanks are fabricated from 150 x 100 x 5mm RHS and hot-dipped galvanized. The chimney was turned from solid aluminium and the curved base was hand filed. The sheet metalwork is made from 3mm thick mild steel to increase the overall weight of the locomotive. The cylinders were machined from an 89mm diameter bolt from a SA mine. The engine frame was oxy-cut from 12mm thick black mild steel and cleaned up with an angle grinder and files. The cast iron wheels were cast from Harold Clisby's patterns. The riding truck is also a freelance design and beefed up for durability.

Andrew Mierisch



Andrew is a 22 year old "A grade" Electrician. His home club is the Diamond Valley Railway in Victoria. He gained some fitting and machining experience in his father's business. Involved in the hobby since he was 5, he became a member of the DVR at the age of 10.

Andrew submitted his 7¼" gauge Victorian Railways X class diesel outline locomotive — X44. The 2½"-to-the-foot scale X class model is a petrol engine and generator to traction motor combination. An HO scale model was used to provide the dimensions.

The petrol engine is a slightly modified 1979 Mazda 323 car engine. The traction motors are 1930s Dodge north-east starter motors. The locomotive body is heavy sheetmetal to avoid the need for internal frame work. The louvres were made with a home-made punch.

Nathan Roberts

Nathan is a 15 year old student and helps his father, Wayne, at the Tullamarine Live Steam Society in Victoria. Nathan built a battery powered Tram outline loco. The motor is from a Holden Commodore air-conditioning fan. The timber body was made from solid ply and the siding was scribed into it. The coupling hook was cut and filed by hand. The electric circuit was a simple resistance type. The buffers were machined on a lathe. The cow-catcher was fabricated from strip steel.

The decision

As you can see the decision for this year's award was difficult. When all the points were added up, the award was presented to Michael Lyas. AME congratulates all the Award entrants. The hobby is in safe hands with this level of skill in our midst!

Conclusion

I promised you a pictorial account of the convention so I won't rave on much longer. Actually I have a lot more photos of the convention to share, I'll slip them in future issues from time-to-time if I have space. We also visited several model engineering tracks in the Adelaide area. I will try to include each of these in future editions as space permits.

I would like to finish off by thanking all the people involved in preparing and running the convention for an excellent event.

I hope to see you at Cobden next Easter!

Ron May can have the last word as he heads for Cobden in '97!

Sand Cast Metal Founding for the Model Engineer

A practical series by Bob White

Part 3 — The Patternmakers Workshop

Photos by Bob White and Drawings for publication by Rod Heslehurst

In the first two parts of this series I discussed the Patternmaker's Initial Considerations (Issue 62) and then delved into more aspects of Patternmaking (Issue 63). Now its time to don the apron and have a look around the partternmakers workshop, and to see what we, as model engineers, need to produce patterns.

Hand tools — for marking out

If you plan to do a lot of patternwork, a 300mm Contraction Rule for the main metal you want to work in would be worthwhile. In imperial days, rules were always graduated on the four edges with a different scale on each edge covering standard on one and three different metals on the others.

Sometimes these were double contraction rates such as aluminium plus iron. A wooden master pattern would then be made to such a scale, cast in aluminium, then dressed up and used as a production pattern for making an iron casting. However, metric rules generally only carry one scale per rule with the contraction rate expressed as a percentage. Contraction rules can be obtained from *Cast Metal Services* in Brisbane and possibly from other engineering patternmakers suppliers as listed in the yellow pages for your state capitol.

A Woodworkers Scriber is a must. These are fine pointed one end, for scribing with the grain and chisel pointed the other end, for actually cutting across the grain. If a pointed scriber is used across the grain the fibres will tear and mar the workpiece.

You could easily forge a chisel pointed scriber from silver steel or alternatively, grind one up from a piece of broken hacksaw blade.

A selection of the essential hand tools needed for patternmaking in the home workshop. The tool in the mid-left of the photo is the panel pin hammer.

A Scribing Block or Gauge is a very cheap tool that is ideal for scribing lines parallel to a surface as is required when dressing timber to thickness by hand.

Dividers should have slim tapered legs with concentric points so they do not offset their position when depressed into the wood.

A cheap Combination Set would provide a good square for general work and a protractor for setting draft angles.

A Pencil and Compass will complete the marking out kit but use HB grade leads as anything harder will indent the timber workpiece rather than leaving an easily visible line.

The art of marking out in patternmaking is similar fine metalwork. That is, it must be as accurate as possible, done with fine linework and those lines which are important references, such as major centre lines, should be permanently scribed in place. These scribed lines should then reproduce right through the process in our small work to show on the final casting.

Hand tools — for cutting

A paring chisel is essential and should be about 25mm wide for in the main it is used to work across the end grain on rather broad flat surfaces. Chisels for patternwork need long blades and long handles to give good manual control of the tool.

A small Block Plane would be next on your list. This could be from 200 to 250mm long.

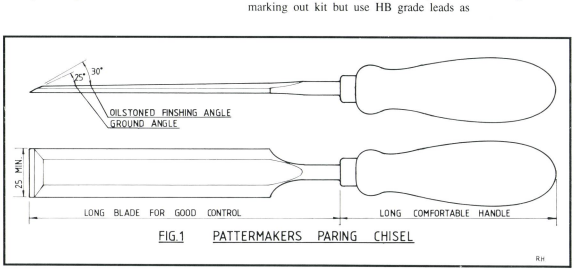


FIG.1 PATTERMAKERS PARING CHISEL

A Panel Saw about 500mm long and with relatively fine teeth would be a must. Keep this in sharp and well set condition and do *not* use it on hardwood. I have always found it easier to use a blunt axe than it is to use a saw in the condition that one finds most amateurs saws.

Wood Rasps with reasonably fine teeth are also handy for roughing out some of the awkward shapes. These need only be about 200mm long. N.B. Bastard cut metal files are not much good for timberwork for they tend to want to travel sideways across the work and leave corrugations. They also have a very poor stock removal rate compared to a rasp.

Another specialist hand held tool is the Wide Jawed Woodworkers Vice. This is essential for the serious patternmaker and it can never be too big in either jaw width or opening.

The metal jaws should be faced with thick plywood which is left protruding at least 10mm on all sides. This protects the work from metal oxides and grime stains. It also protects tool edges (that may run astray occasionally) from the damage of ploughing into the metal jaws.

Most other requirements will come from your metal working kit, but a panel pin hammer would be a worthwhile addition if you can locate one. You will also require an accurate set of scales if you are to do epoxy resin work. The kitchen ones may do at a pinch, but be ready for the fireworks when the lady of the house discovers the inevitable dollops of rock hard plastic and plastic finger prints that will surely end up on them.

Last but not least will be a small plasterers trowel for working bog. Chisels and plane blades should always be ground to the correct angle of 25 degrees for our soft timbers and must be finished a few degrees steeper on a good oilstone. (Refer to Figure 1) They should always be (and I repeat *always*) be kept sharp enough to shave the hairs off your arm. Tools in this condition are a pleasure to use and should be handled and stored carefully so as not to damage these edges. For instance, never sit the plane on the bench on it's working face but rather lay it on it's side. Likewise the paring chisel, always place it upside down on the bench and away from other tools.

Machine tools — the disc sander

I regard the disc sander as the most essential of all patternmaking equipment. It can save hours of hand work on even the simplest jobs and it gives a far superior surface to boot, in that the chosen draft angles remain constant right across the work face. That is they do not vary or worse, undercut, at the joint face extremity as tends to happen with hand sanding.

The sanding disc is out on it's own for working across the end grain, also for flat and convex surfaces. Most industrial pattern shops have a disc sander at least 900mm in diameter. This is not so much to handle very large work but so that a position on the disc can be selected to give the correct cutting speed. For example, "end grain" needs working slower than "with the grain". Note especially that plywoods need an even slower cutting speed again.

If a disc is worked too fast for the timber in hand, it will rapidly clog and begin to leave burn marks on the work. In the worst case, it can easily start a fire in the waste collection area or bag.

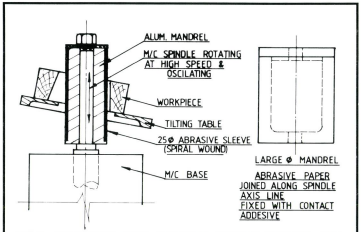


FIG.3 SCHEMATIC SECT THROUGH BOBBIN SANDING M/C.

Three foot diameter is of course out of the question for our home workshops but if you are at all serious about making patterns it is well worth investing in a decent sized hobby sander or even making one. Do not select anything below a 250mm disc diameter and don't bother choosing a machine that has a belt on the other end as you will seldom use it for pattern work and when you do, you will find that the belt tends to lift off the supporting table just as it encounters the workpiece thus giving a slightly rounded surface right at the leading edge. If you live within cooee of a shearing shed, you may be able to get the owner to part with the old cutter grinder. These would adapt well to the task.

Grit size for disk's should be no finer than 60 or 80 or they will clog and burn and the peripheral speed of the disc should be about 30 metres/second. The paper is fixed to the metal disc with contact cement and trimmed to diameter with the flat of the hammer afterwards.

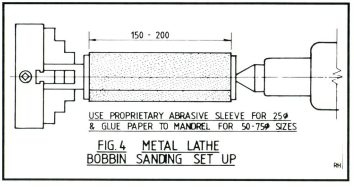
Ideally the sander would have a work support table capable of being tilted for draft angles. If your pocket is only deep enough for a fixed table, do not despair for you can easily make up a set of supporting wedge shaped pads in timber to sit on top of the square table which will then support the work at the desired draft angles.

Machine tools — the bandsaw

This is almost as indispensable to the serious hobbyist patternmaker as the disc sander. It only need have a throat large enough to take your general run of work and need not have a tilting table. Make sure it is robust in construction (especially the table supports) or it will chatter on thick work.

Blade width and tooth spacing will depend a bit on the size of the machine but about a 6 to 8mm wide blade with 6 to 8 TPI would be a mean guide for a machine with 300 to 400mm

This patternmaker at work on a purpose made bobbin sander, which includes its own dust collector. Note the table angle for the "automatic" inclusion of the correct draft on the master pattern being produced.



diameter band wheels. Surface speed should be around 900 metres per minute for our soft timber.

Machine tools — the lathe

All the work you will ever want to do in the hobby can be done quicker and easier in your existing metal turning lathe than on a wood turning lathe. Don't think I am knocking the wood lathe but rather stating that it requires some skill to operate quickly and accurately and more importantly, safely. You have no need what so ever to run out and buy one to be able to make a few loco wheel patterns.

Cutting speeds

For timber they should be considerably higher than for metal of course, but you will still need to take it steady until you have the corners off the blank and reduced the out of balance. Security in chucking the workpiece can often be your limiting factor in cutting speed.

Methods of holding

Methods for holding the wooden workpiece in the metal lathe are much the same as those for holding metal work. Plywood packing pieces should be used under the chuck jaws on finished surfaces that are being rechucked to spread the bite of the jaw over a larger surface area than the jaw would do alone, thus preventing indentation of the finished surface.

Chucked work can often be handled more conveniently by screwing a 12mm plywood chucking piece to the back of the work. This then leaves the outside unencumbered by chuck jaws.

A paper joint can sometimes be used to fasten the work to a chucking piece if only light turning is to be done and the work section is too thin to accommodate fixing screws. Paper joints are commonly used to joint the two pattern halves together for turning when the joint lies along the lathe axis.

These joints consist of a piece of newspaper placed between the two PVC glue coated timber surfaces. The work can be prized apart again with a paring chisel when the job is completed, with little damage to the joint. The remaining paper and glue is then dressed off with the chisel.

Cutting tools

For soft timber need more clearance than they do for metal and considerable more rake. A large point radius is also desirable.

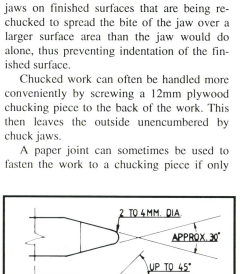
A good general purpose tool form for both sliding and surfacing is illustrated in Figure 2. This tool will work best when the shank is positioned at roughly 45 degrees to the direction of travel so that the tool cutting edge actually pares the timber away rather than scrapes it. The same form can be applied to boring tools.

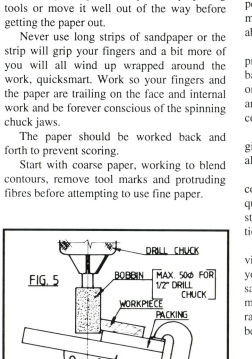
Sanding of finished work should be done in the lathe at a slow surface speed so as not to burn the fingers that are manipulating the paper. Always strip the toolpost of projecting tools or move it well out of the way before getting the paper out.

Never use long strips of sandpaper or the strip will grip your fingers and a bit more of you will all wind up wrapped around the work, quicksmart. Work so your fingers and the paper are trailing on the face and internal work and be forever conscious of the spinning chuck jaws.

The paper should be worked back and forth to prevent scoring.

Start with coarse paper, working to blend contours, remove tool marks and protruding fibres before attempting to use fine paper.





Actually, very little stock removal is done with the fine paper. The coarse is a different story though and some allowance will have to be made on the turned size to allow for this material removal.

Painting

This can also be done while the job is in the lathe, with the lathe stationery of course and then further sanding can be conveniently carried out between coats.

Other machinery

Your existing drill press and bench grinder will complete the basics but if you want to get right into this timber scene and can afford it, then by all means add a combination sawbench and planer. Just as with the sander, select something with some size to it for the market offerings at the bottom of the range are little better than toys and will forever be a disappointment with overheated motor stalls, slipping belts and severe restrictions in useful working capacity.

For the guy who has to have everything a bobbin sander like the one in the photo would be the bee's knee's. Bobbins are invaluable for shaping concave surfaces quickly and accurately particularly when working across end grain. Figure 3 details the key parts of a commercial bobbin sanding machine.

But for those of us who can't have everything you can make up fairly good substitutes for use in the lathe or drill press as detailed if Figures 4 and 5. The key difference between these and the commercial machine is that our home made bobbins will not oscillate the paper back and forth over the workpiece to remove scores made by protruding grains of abrasive.

With the lathe mounted bobbin this is no problem for we can simply move the work back and forth by hand but of course we can only offer the work to the bobbin freehand and so will have difficulty in maintaining a constant draft angle.

On the other hand the drill press set up will give you a constant angle but still does not allow for oscillation.

The resulting work scoring can be overcome to some extent by roughing out at one quill setting and then finishing at very small stock removals with the quill in other positions.

So as with all hand processes, each individual will develop their own techniques but you can rest assured both the sanding disc and sanding bobbin are among the patternmakers most highly prized pieces of equipment for rapidly and accurately shaping pieces of timber to finished contour sizes.

To be continued ...

The Ultimate User-friendly Turnout?

Ian Clark outlines the design of a swing-rail turnout that accepts all wheel profiles and banishes problems of derailments in dual gauge situations

Drawings for publication by Brian Carter

Was it possible? To build a dual-gauge turnout that would let wheels of all profiles and standards go through — without fail? My quest came about, back in the mid-seventies, in response to a lot of interesting problems.

A mixed bag of standards

When the SASMEE dual-gauge ground track project started, I investigated the various wheel standards on locomotives and riding trucks that were in use on our system. They were many and varied!

At the time, there appeared to be no accepted Australian wheel standards for either 5 inch or 7¼ inch gauges. However, the 5 inch standard developed by the Sydney Live Steam Locomotive Society was considered very practical, so we adopted it in preference to the finer British ME standard. The main reason was that the thicker flange and wider tyre gives much better "mileage" between wheel replacements and it is better able to withstand the impact of derailments. Castledare Model Railway's 7¼ inch standards were also considered practical, and they too were adopted in preference to the finer British standard. Today's AALS wheel profiles for 7¼ inch fine scale and 5 inch narrow gauge are, for all practical purposes, the same as those Castledare and SLSLS specifications which have stood the test of time.

Dual-gauge problems

Even when you stick to AALS standards, however, problems occur in dual-gauge turnouts because you are dealing with two different scales. — *This is discussed in "Our incompatible track standards" on page 38 ... ed.*

The variety of wheel standards on our existing locos and rolling stock, together with unknown variations on visiting equipment, made us acutely aware of the problems involved in designing dual-gauge turnouts.

It had been decided, when the project started, that the new dual-gauge facilities should be available to all members and that no-one should be excluded from running a loco because of any restriction in the new track.

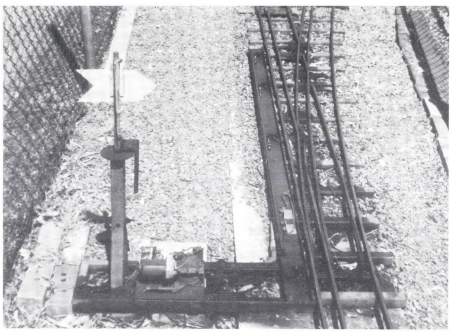
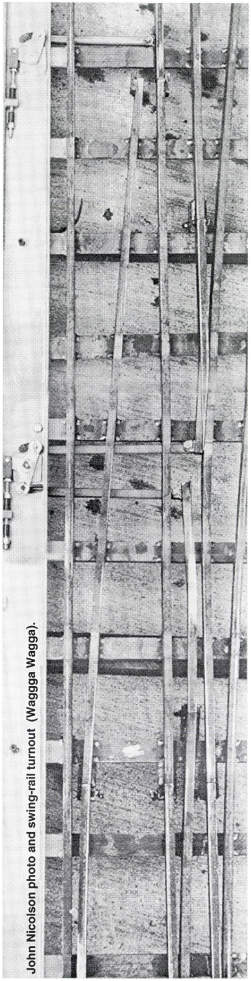


Photo 1. *General view of one of Ian Clark's turnouts at SASMEE with all the covers off. The long channel contains a long push-rod and bell-cranks. The short push-rods extend from under the channel, under the rails to the switch-blades and crossing blades. The turnout is normally power-operated but can be switched, whether power is on or off, by lifting and turning the handle on the switch-stand. The large "target" is easily seen through steamed-up glasses. and the usual clouds of steam and smoke!*



John Nicolson photo and swing-rail turnout (Wagga Wagga).

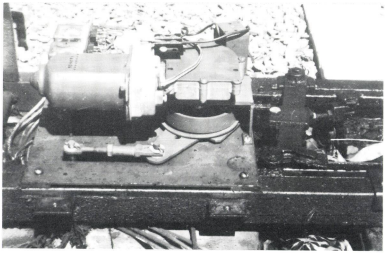


***Photo 2**. Point motor drive mechanism. After the blades have been moved over, the mechanism at the right firmly locks them in place, and the motor is disconnected via the clutch.*

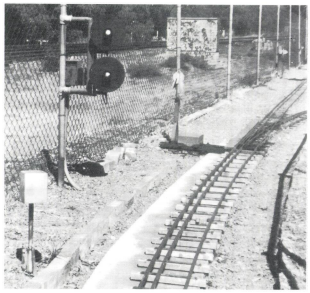


***Photo 3**. Drivers at Millswood set the route at the trackside control box (foreground). The push-buttons are shrouded from "little fingers." The two searchlight signals are used as route indicators but will indicate "red over red" if switch-blades do not close completely. Similar turnouts at Wagga Wagga and Canberra are manually operated.*

Basically there were two problems:

- within either gauge, the check rails would not necessarily accommodate all variations because of different wheel standards within that scale/gauge, and
- the gap in the two check rails that have to accommodate both gauges could not cope with the smallest 5 inch standard and the coarsest 7¼ inch standard.

Only one answer

The solution was to design turnouts with movable frogs (crossings), so that check rails would not be needed. Experience in a number of clubs has shown that this is the only completely reliable answer to deal with the variety of wheel profiles and/or the standards of two scales.

The design that I developed for SASMEE, shown in photo 1, is based on pivoted rails that swing to one route or the other at the same time as the switch-blades are moved over. These pivoted rails completely replace the crossings ("frogs"). There are no flangeway gaps for wheels to run over. Check rails and wing rails are eliminated because they are not needed. The blades are locked after they move into place; the turnouts can be operated by electric or manual operation; and signals are interlocked with them.

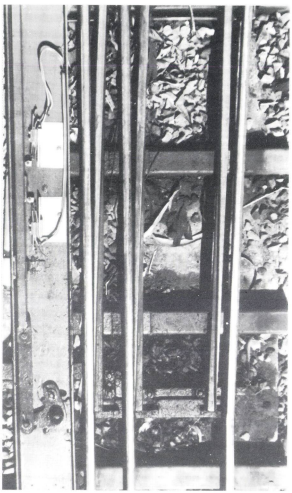


***Photo 4**. Points set for the right-hand route. Note the signal interlock contacts activated by the movement of the blades.*

Features

Some of the design features are as follows:

- No pivoted rail or switch blade is under pressure — there are no springs in the system. The travel of the switch and crossing blades is set so that the blades just close against the stock rail, after which they are locked in position.
- The points can be operated manually should a fault arise (even if the power is on), or if the power has failed.

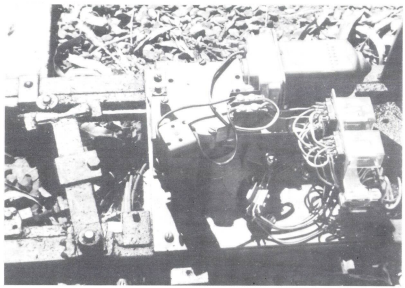


***Photo 5**. The point-motor drive unit. Right, motor control relays; centre, motor clutch solenoid; left, the "blade travel and escapement arm".*

- The point-motor drive mechanism (a 12 volt automotive tailgate unit) drives the switch-blades through the switch-stand linkage.
- A solenoid-operated clutch engages the drive motor to the switch-stand linkage and releases it after the switch-blades have completed their travel.
- In the rare case of mechanical overload, due to a stone or twig jamming the blades, the clutch will continue to slip out of engagement, preventing damage to the drive mechanism. A refinement would be to have a timed lockout for such a condition, but I have not seen the need at our track.
- The switch-stand linkage moves the switch-blades via an escapement which locks the blades in either position, as in full-size practice.
- The point-motor power supply is separate from the signal supply, also as in full-size practice.
- The route-indicating signals are interlocked via the movement of the switch-blades. If the blades don't complete their travel, both route-indicating signals indicate "red over red".
- All movable blades have adjusters. Once set, they very rarely need attention.
- Drivers may set the route from trackside buttons as they approach a turnout.
- Because the rails are locked in position, trains cannot trail through; the road has to be set specifically.
- The approach signals to the trailing points are interlocked to the movements of the blades and are "absolute".

Reliability

The whole system works well and has given little trouble for almost 20 years in accommodating any loco or rolling stock in 5 inch and 7¼ inch gauges.

Our incompatible track standards

Clive Huggan comments on the reasons we encounter problems in dual-gauge turnouts and reviews swing-rail turnouts.

Much confusion and many a furphy is spread in our hobby about track standards.

Nowhere is this more apparent than in turnouts — "she'll-be-right" engineering practices don't give the reliability we need. Ian Clark hits the nail on the head when he raises the two main problems with turnouts:

- Firstly, within a particular scale or gauge the check rails don't necessarily accommodate all variations in wheel standards.
- Secondly, with dual gauges, the gap in the two check rails that handle *both gauges* can't cope with the finest 5 inch standard and the coarsest 7¼ inch standard.

What exactly is the problem?

I've heard some people deny there is a problem with reliability on conventional dual-gauge turnouts. They say they have fine-tuned theirs by removing metal from the flangeways (the channels in which the wheel flanges run) with an angle grinder until everything works well. But most of these people acknowledge that reliability falls off once the track has worn, and that visitors' locomotives will derail more often than club members' locos.

Can we improve on that? After all, many model engineers — especially owners of fine-scale models — have an aversion to derailing at all.

To find out, it's worth looking into the underlying causes of the problems.

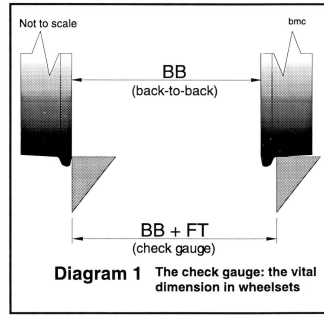


Diagram 1 **The check gauge: the vital dimension in wheelsets**

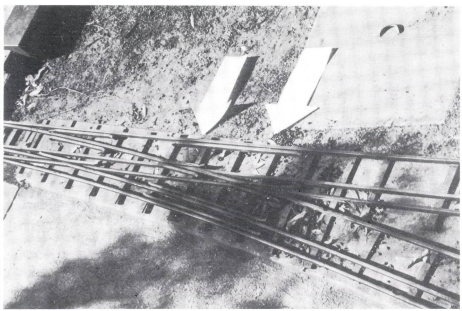


Photo 6. *A conventional dual-gauge turnout. The arrows show the positions where the flangeway must cope with wheels built to two different standards.*

Most model engineers are careful to ensure the back-to-back measurement (BB in diagram 1) complies with AALS standards. Even more important than this, however, is the check gauge (BB+FT in diagram 1).

The importance of the check gauge is evident when wheels go through the gap at the crossing or "frog". The crucial event occurs as the wheel arrives at the very tip (the "nose") of the crossing vee (diagram 2).

Assume there's a force pushing the wheelset to the right, as on the curved route. Unless the wheel is held in check, it will go too far to the right, causing it to enter the wrong gap — and go up the flangeway to the right of the vee. The component that prevents that happening is the check rail. I've tested this aspect while building a turnout, before welding the check-rail in place: a wheelset rolled along the curved route will try to go straight and invariably will head up the wrong flangeway.

An essential part of turnout design, therefore, is to ensure the check rail holds the wheel in *exactly* the right position as its op-

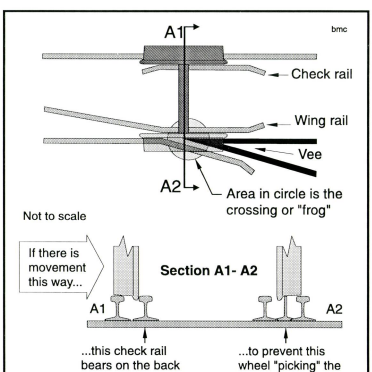


Diagram 2 **How the check rail works**

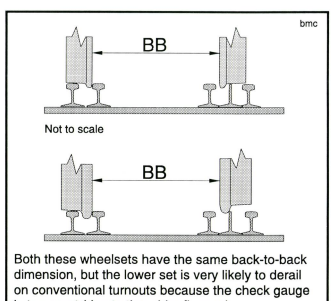


Diagram 3 **Why the check gauge is critical**

posite number goes through the gap. That's achieved by ensuring that track and wheels conform to specifications for the check gauge.

Maximum and minimum values for the check gauge, and other associated dimensions, have been established to ensure maximum reliability. In full-size railway practice, therefore, derailments at crossings/frogs are extremely rare. We can achieve a similar result if we build track to AALS standards for our gauge, and only run locos and rolling stock that comply with AALS wheel standards.

However, normal problems of maintaining accuracy under every-day wear and tear are compounded when the turnout has to cater for more than one set of standards, i.e. for more than one gauge in a turnout.

In a dual-gauge turnout for both 7¼ inch and 5 inch gauge, four of the flangeways handle only 7¼ inch gauge wheels and two handle only 5 inch gauge wheels; they do not hinder wheels of the other gauge. However, two other flangeways must handle both 7¼ inch and 5 inch gauge wheels: the arrows in the photo show their position, the left arrow being opposite the 5 inch crossing and the right arrow opposite the 7¼ inch crossing. (The turnout in the photo has the two check-rails combined into one, but the principle is the same).

Dimensionally, the problem is that the minimum AALS flangeway in 5 inch gauge is 4.8mm, and the maximum in 7¼ inch gauge is 9.32mm — almost twice as wide. Therefore, when the flangeway is wide enough for the 7¼ inch wheels, it's too sloppy to ensure the 5 inch wheels will never foul the crossing vee. Conversely, if it's narrow enough for 5 inch wheels, it will pull the 7¼ inch wheels over and possibly derail them. With this wide range, there isn't really a reliable compromise dimension in between.

The only way to run very reliably on dual-gauge tracks is to:

- separate the tracks where there are turnouts, so that all turnouts are single-gauge, and insist that every wheel complies with standards; or
- eliminate those two incompatible check rails altogether.

Ian Clark's design achieves the second of these alternatives.

Do they work well in practice?

Wherever I've seen them I've been impressed by the way these turnouts overcome the problems of dual gauge. Ian's turnouts have been

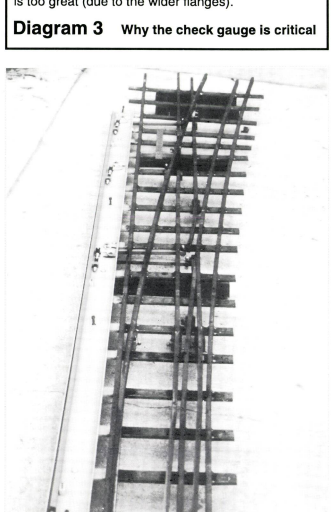


Photo 7. *A variant of Ian Clark's design built by John Nicolson. This design has given sterling service at the Wagga Wagga and Canberra clubs.*

Table of offsets (in mm) for a 20m radius curve (100mm intervals)

	y	x	
Practical toe of point with stock rails offset	0	0	Theoretical toe of points ←
→	100	0.3	
→	150	0.6	
	200	1.0	
	300	2.3	
	400	4.0	
	500	6.3	
	600	9.0	
End of milling →	700	12.3	
	800	16.0	
	900	20.3	
	1000	25.0	
Heel →	1020		
	1100	30.3	
	1200	36.0	
	1300	42.3	
	1400	49.1	
	1500	56.3	
	1600	64.1	
	1700	72.4	
	1800	81.2	
	1900	90.5	
	2000	100.3	
Theoretical point of crossing — 5° gauge	2100	110.6	
→	2200	121.4	
→	2250	127.0	
	2300	132.7	
	2400	144.5	
	2500	156.9	
Theoretical point of crossing — 7¼° gauge	2600	169.7	
→	2700	183.0	
→	2706	184.0	
	2800	197.0	
	2900	211.4	
	3000	226.3	

These dimensions are for a straight turnout with a curved route of 20m radius without gauge widening. To gauge widen, first plot the coordinates and then offset the inside curved rails to the desired widening (i.e. the curved stock rails). This will not alter the theoretical point of the crossing.
For Y points, plot the curve either side of the centre line along which dimensions "y" are marked.

in use at SASMEE Park for almost 20 years. At Box Hill and Palmerston North clubs are similar turnouts, built to a design of Henry Holder of Carnforth, England, published in *Model Engineer*. And Len Peckham has just installed one at Penfield, which worked well at the AALS convention.

I'm especially familiar with turnouts incorporating minor developments on Ian's design, built by John Nicolson, at the Wagga Wagga and Canberra clubs. All of them are as reliable as ordinary (i.e., non-turnout) track.

Two of the turnouts at Canberra (built 10 years ago) are in locations that can't be handled by conventional turnouts: "curve-on-curve" situations, where the angle at which the tracks diverge is so small that the rail gaps at the crossings would become extremely long.

Similar design solutions are now being applied in full-sized practice on railways as diverse as heavy-haul lines and high-speed passenger lines like the TGV. In Australia they are in use on the iron ore railroads of the Pilbara. There are at least two other examples: in NSW at Glenfield Junction and in WA at Forrestfield Yard.

Ian Clark's considerable experience in full-size engineering, and his concern to build in reliability, come through in his design. Although these turnouts take longer to build than the conventional type, time is recouped by savings in maintenance: their initial adjustment is very easy and very little is needed subsequently. These turnouts are a great way to permanently eliminate the "nuisances of dual gauge".

More information on the complex subject of wheel-and-rail standards can be found in the five articles written by Dr Martin W. Baker in Engineering in Miniature *between January and May 1994 and in letters in the Sept, Oct and Dec '94 issues...ed.*

Notes on Screwcutting

by Dick Atkins

Drawings for publication by Neil Graham

These notes are intended for relative newcomers to the hobby, old hands need no help from me and need not read further. I am no expert on these matters and merely relate my own experience, it may be of interest and hopefully helpful to some.

Folk who have recently acquired a lathe seem to be in some sort of awe at the prospect of screwcutting. It is imagined to need much calculation in relation to the setting up of change-wheels. Then there is the bother of actually setting them up, (they are most likely to be in fine feed mode), then the bother of resetting to fine feed. All of which takes longer than the actual screwcutting job, as we rarely need more than one or two off.

The temptation is to use thread cutting dies instead and we have all experienced the fiddling about needed to adjust them. For the not uncommon reason of "financial stringency" I had to put up with this situation for years, later, I was fortunate enough to be able to acquire a Myford lathe with a Norton change-gear box. Screwcutting then became a breeze.

The theory

It is not generally realized how 'poor' a fit a threaded connection can be and still be serviceable. With the best will in the world there will be errors, even the experts make a "blue" now and then. Standards recognize the occurrence of dimensional errors, form and pitch errors, making allowance for inevitable discrepancies.

These notes are in relation to the sizes listed in the table, namely; 40 to 12 threads per inch. Unless you are into the "Big Stuff" the table will cover most jobs.

There are three classes of screws, viz. Close, Medium and Free, also three classes of nuts, namely, Close, Medium and Normal.

A small allowance on diameter of about 1½ thou. is applied to the Medium and Free classes. In addition a tolerance is applied to all classes. In the case of Free and Normal threads, the tolerance on the major diameter ranges from 6 to 12 thou.

The tolerance on the major diameter quoted in the table is akin to that for Close fits, but if exceeded, not to worry! The tolerance on the minor diameter for nuts ranges from 9 to 25 thou.

In the case of what may be judged a sloppy fit, still within these tolerances, the percentage thread engagement will average about 75%. Some commercial fits are as low as 60% thread engagement and still function satisfactorily.

None of this is intended to suggest that care should not be taken to obtain as good a fit as possible, but merely to indicate that the cutting of threads is not something to shy away from. There is nothing like practice to gain confidence.

The practice

I assume most female threads will be formed by tapping. Taps vary, even new ones, and if like mine, yours are past the ideal use-by date variations are to be expected. Ground-thread taps are a luxury not many of us indulge in.

It is recommended that the female thread be finished first, this can then be used as a gauge when screwcutting the male thread.

The procedure

a) Turn part to be threaded to required outside diameter (see sketch)

b) With narrow parting tool (1/16"), cut run-out groove to thread depth.

c) Chamfer leading edge to at least depth of thread.

d) Using slow back-gear, cut thread, using whatever number of passes feels comfortable.

e) Before reaching the final depth, leaving, say 5 thou. run a dead smooth file lightly over the threads to remove burrs. The right index finger is a good sensor! (lathe stopped).

f) Take another pass at the same setting to clean up.

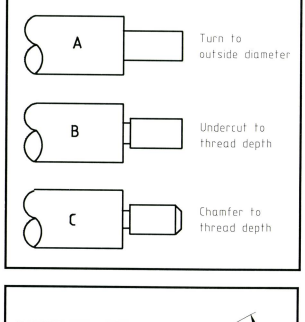
g) Check with female thread.

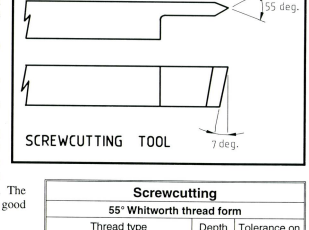
h) Carry on until the required fit is obtained.

Tooling

For the sizes being considered, one tool suffices, while perhaps not technically correct, the results are quite satisfactory and save a lot of hassle. The tool should be formed with a 55° included angle, the tip should be stoned off a couple of thou. and rounded. The whole thing is offset as sketch, to allow working up to a shoulder or close to the chuck. Top rake is zero and front clearance 7° The cutting edges should be carefully honed for a good finish.

Happy screwcutting.





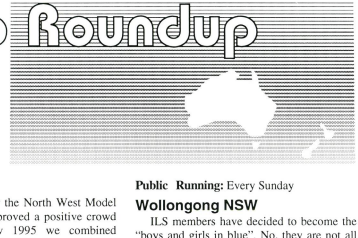
Screwcutting

55° Whitworth thread form

Thread type				Depth of thread	Tolerance on diameter
TPI	BSW	BSF	ME	0.000"	0.000"
12	9/16	13/16	–	53	6
12	½	¾	–	53	6
14	7/16	–	–	46	6
16	3/8	9/16	–	40	6
16	–	½	–	40	6
18	5/16	7/16	–	36	5
20	¼	3/8	–	32	5
22	–	5/16	–	29	4
24	3/16	–	–	27	4
26	–	9/32	#	25	4
28	–	¼	–	23	4
32	–	3/16	#	20	4
40	1/8	–	#	16	3

Note: Tap the female thread first. Adjust the male thread to suit if necessary.
All Brass threads = 26 tpi.

Club Roundup



Ulverstone Tas

A new venture for the North West Model Engineering Society proved a positive crowd pleaser. During Nov 1995 we combined forces with the Historical Machinery Club of Tasmania.

The programme was very interesting and presented a wide range of action for the visiting public. The HMC members displayed over 50 old-time farm and vintage machinery — all restored a fully operational! The highlight was the appearance of Tasmania's only working Sentinal Steam Lorry!

The NWMES ran three 7¼" gauge steam and three diesel locos and one 5"g loco. Welcome visitors were two diesel locos from the Evandale Miniature Railway and one from the Roseberry Club.

NWMES members displayed their models, some completed and some still under construction. The days activities concluded with a BBQ — good weather was a major factor to a successful and happy day!

North West Model Engineering Society
Location: Ulverstone Tas, 2km east on the main highway from the Post Office.
Public Running: 3rd Sunday

Eltham Vic

A record year! 75,000 passengers hauled! The folks at the Diamond Valley Railway have certainly been busy. 1996 is also shaping up to be a busy year. This year the DVR are embarking on a large site improvement and beautification project through a Commonwealth Department of Employment, Education and Training job creation programme. The project includes creation of a wetlands area opposite the Diamond Valley Station, construction of new pathways near the station, landscaping of various areas around the railway, excavations of the new platform site at Pine Creek, repainting buildings and signal equipment.

Ongoing way and works projects have seen the 66th set of points constructed, two new station name boards, some track re-alignment and lengthening of the Diamond Valley East Yards.

DVR member Doug Baxter won the trophy for the best model at the Melbourne SMEE end of year meeting for his model of a Victorian Railways 30 ton wrecking crane.

Diamond Valley Railway Inc.
Location: Eltham Lower Park, Main Road, Eltham
Public Running: Every Sunday

Wollongong NSW

ILS members have decided to become the "boys and girls in blue". No, they are not all joining the police force! The club has adopted navy blue as the colour for members uniforms, with the choice of garment left to the individual. The club is purchasing pocket patches with the ILS insignia.

The Australian Miniature Locomotive Trials were held on the Australia Day weekend with glorious weather, lots of yarns and some pretty imaginative excuses. There were twelve participants, the winner being Ross Bishop-Wear on 5906. Ross's load was 1376 kgs and no stoppages were recorded.

Illawarra Live Steamers Co-op Ltd
Location: Stuart Park, Virginia St. North Wollongong.
Public Running: 4th Sunday

Nelson NZ

The Committee has decided to revert to the original monthly timetable as it is felt the change last year has no advantage. In future the Society's activities will be: 2nd Tuesday General Meeting; 3rd Tuesday Steam Night; 4th Tuesday Committee Meeting.

The boat pond has been filled with bales of barley straw. It is believed this is one method of removing algae. It is now a case of wait and see. A very high tide recently covered the jetty and the path around the pond as well as part of the railway track. Passenger hauling had to cease until the tide receded as the trolley footboards were under water.

Nelson Society of Modellers Inc.
Location: adjacent to Tahunanui Beach, Walkare St. Nelson.
Public Running: Every Sunday.

Wellington NZ

Maidstone Model Engineering Society have received from the OSH service of the Department of Labour a second Draft of the Proposed Code of Practice for Safe Operation of Amusement Devices, which includes a section on miniature railway systems. It is proposed that Model Engineering Societies act in a self regulatory manner and that suitable rules and safety standards for public operation be adopted and submitted to OSH for approval together with an Engineer's Certificate covering examination of the track. Registration will be given on acceptance of the rules. Members feel their existing safety and operating rules should prove adequate.

Maidstone Model Engineering Society Inc.
Location: Maidstone Park, Upper Hutt
Public Running: Unknown

Paraparaumu NZ

Members have adopted a constant venue and date for meetings to avoid the previous "ring around" to remind people. Meetings are to be at the Marine Gardens Railway on the 2nd Sunday from 1.30 to 3.30pm

The steel for the car siding has been purchased and fabrication of the track sections and the set of points is under way.

Paraparaumu Associated Modellers Inc.
Location: Marine Gardens Railway, Raumati Beach.
Public Running: Every Saturday and Sunday (weather permitting)

Galston NSW

The station appearance has been enhanced by the erection of an improved *Galston Valley* sign and scaled down advertising hoardings based on NSWGR steam days prototypes. The six riding cars for the second club train are now in operation and a transportable building for a library and office has been purchased. The old library has been converted into a canteen, craft and toiletries store.

The three day Annual Birthday Weekend was a huge success with a large number of locomotives running as well as a considerable static display. The newly completed 172 metre model road vehicle track was officially opened with two traction engines immediately putting it to good use. A feature of the weekend was the operation of the Ronaldson Tippet Engine which has been fully restored by Garth Cantrill. Vernon Brown won the Society's trophy and cash prize for a non-railway model with his Quorn tool and cutter grinder.

At the Annual General Meeting in April the members voted on a change of name for the society. It was felt that the name was too long when dealing with "outside business". The familiar HDMES is now HME as it is:

Hornsby Model Engineers Co-op Ltd.
Location: 29 Mid Dural Road, Galston.
Public Running: 2nd Sunday

Gisborne Vic

The Society have decided the best way to raise money is to participate in the monthly Gisborne Market. To this end they plan to either procure a portable track or a rubber-tyred train.

In 1989 VicRail donated a hand operated inspection trolley to the Steam Park railway. With restoration work on the Perry locomotive basically complete, the ganger's trolley became the next project. It was regauged from 5'3" to 2ft and rebuilt and since being brought into use has proved to be very popular, particularly with the children.

Gisborne and District Steam and Engine Society Inc.
Location: Gisborne Steam Park, Webb Cres.,

New Gisborne
Public Running: 1st Sunday

Wanganui NZ

The track has finally dried out after being inundated and damage is not as bad as was first thought. Running is again the order of the day. With the grounds now back in order, members are eagerly looking forward to cleaning down, scraping and painting the meeting room before winter sets in.

Wanganui Model Railway and Engineering Society Inc.
Location : 70A Alma Road, Wanganui
Public Running: Unknown

Warner Qld

At the Annual General Meeting in February, Neil Dannenberg was elected to the position of President. Bob Campbell is Secretary and Jess Balcombe-Jestico is Treasurer. Well known clockmaker, Roy Skyring, along with Mrs Skyring, was conferred with Life Membership.

The club's annual Trophy Day was an outstanding success. There were plenty of locos running, Roy Skyring brought along a fresh crop of clocks and Eric Evans brought his finished traction engine. "Give me a loco to build any day" he says. As well as the fleet on the track there were thirteen unfinished locos on the display tables, six clocks, an assortment of workshop machinery, rolling stock, a model QR DH loco and a Cliff & Bunting traction engine. The Championship Cup went to Hugh Elsol for his 3½" gauge LNWR 2-4-0 *Hardwicke*. The Unfinished award went to Bill Williams for his QR class C16 loco and the Engineering - Machinery prize was won by Bruce Innes for a container wagon. Roy Skyring's Pithead clock took the Horology award, Dallas Golding's QR class A-10 the Myford Cup, Hugh Carseldine's Cliff & Bunting, the Australian Prototype prize and the Junior Encouragement Award went to Owen Coster.

Around the track, the old signal box has been demolished as all control is in the Jubilee box now. The station now looks much tidier as the signal gantry and a bunch of overhead cables were removed at the same time. The signal box roof is used as an additional means of collecting rain water for boilers. The next major project at Pine Valley is the construction of a modern toilet block to supercede the current rustic facilities. The new block will be in approximately the same position as the existing one and use a storage tank method of disposal, serviced regularly by a contractor.

It is also intended to construct a new set of roundhouse style steaming bays for the elevated track. The Committee has also set as priorities station area trackwork, contouring traction engine track, collection and removal of all rubbish and excess material on site, station rebuild, landscaping, a roundhouse, track extensions and a clubhouse.

Queensland Society of Model and Experimental Engineers Inc.
Location : Lot 5, Warner Road, Warner
No Public Running

Bracken Ridge Qld

The northern Brisbane suburb of Bracken Ridge is the site of the latest ground level railway in Queensland. Officially opened on 24 March this year, the track is well over half a kilometre of 5" gauge railway set in concrete in the style of several others in this state. The CME and chief architect of the project is Neil Mackenzie, an active member of QSMEE and MELSA (Maryborough). From the outset the track was designed as a driver's track with very long straights, testing grades and plenty of curves of varying radii. There are also a large number of sidings with an extensive marshalling/storage area under construction.

The track is not a live steamers club in the ordinary sense as it is owned and operated by the Bracken Ridge Central Lions Club, several members of which are also members of MELSA. The emphasis is on model STEAM locomotives and all visitors are most welcome. The track is located in McPherson Park (behind the Bracken Ridge Tavern) and is an easy few minutes off the Gateway Motorway and the Bruce Highway.

Bracken Ridge Central Railway
Location : McPherson Park, Denham Street, Bracken Ridge
Public Running: Last Sunday

Auckland NZ

Break-ins, vandalism and security issues have become a real problem for the ASME members. The Clubhouse basement was targeted over Christmas, nothing taken but some damage was done. A few weeks later the engine shed was broken into, six passenger trolleys scattered around, one loco outside with cab missing and dents in the boiler. The club petrol loco had its superstructure ripped off, beaten flat and strewn around the station area, the chassis elsewhere. A third loco suffered minor damage. Other equipment was generally vandalized and thrown about. In light of this and other attempts in recent months, the alarm system is to be further upgraded in the engine shed and the electric loco shed similarly to the one in the Clubhouse.

On a more positive note, past president Alan Gasteen has been awarded Life Membership of the Society for his outstanding efforts over the years.

Auckland Society of Model Engineers Inc.
Location : Peterson Road Reserve, Waipuna Road, Panmure
Public Running: Every Sunday

Scale Marine Modellers Inc.

Members visited the Hamilton club for a day sail and with seventeen or so at the pool ready to sail the course by 10am it was a good turn out. Unfortunately the rain set in but did not halt proceedings. A model of note was a really small tug, only 200mm long, driven by a stripped servo and still has room for batteries!

It is hoped to have reciprocal arrangements with a new club which has been formed on the North Shore called the North Harbour Model Boat Club. Several members of SMM who live on the Shore are members of the new club as well. They plan to use the Link Road stormwater pond beside the motorway near Tristram Ave.

Location and operations: same as for Auckland Society of Model Engineers above.

Fairfield West NSW

The Annual General Meeting was the occasion for conferring Life Membership on Frank Fitzgerald, who with his 57 class loco, has been a stalwart on the club track for many years.

President is Sam Stowe while Bill Britton is Secretary. The club also has a new mailing address:

PO Box 403 Mt. Pritchard 2170.

Western Districts Live Steamers Co-op Ltd.
Location : Fairfield Showgrounds, Smithfield Road, Fairfield West
Public Running: Every Saturday

West Ryde NSW

Two club members have been running locomotive trials with a five car train on the elevated track, loaded with half cwt. (51 kg) weights. The trial was successful with standing starts at many of the more testing locations on the track. This is to be followed up with trials using live passengers (as opposed to dead ones?)

The railing around the signal box deck on top of the carriage shed has been completed and looks very professional. The new sections of track for the ground level railway are now stored under the steps of the footbridge.

Sydney Live Steam Locomotive Society
Location : Anthony Road, West Ryde.
Public Running: 3rd Saturday

San Francisco USA

To avoid clashing with events in other clubs on the West Coast, the Spring and Fall meet dates are to be the same every year. The dates will be the 2nd weekend in May and the 2nd weekend in October. Visitors from overseas can now plan ahead if planning a visit.

Golden Gate Live Steamers Inc.
Location : Tilden Park, Loma Cantadas and Grizzly Peak Blvd. Berkeley, California.

New Plymouth NZ

Labour weekend was a great success. Visitors came from Auckland, Tauranga, Palmerston North and Paraparaumu. The weather was not wonderful and on the Saturday evening everyone adjourned to the local fire station to check out the searchlight which some members obtained from the Army and restored. It is now used by the local Search and Rescue.

Over Christmas the club undertook day and night running from December 26th to January 8th, as with the Club's proximity to

Pukekura Park it made a great addition to the Festival of Lights, which New Plymouth has become well known for.

New Plymouth Society of Model and Experimental Engineers Inc.
Location: Cnr. Liardet and Gilbert Streets, New Plymouth
Public Running: Every Sunday

Tauranga NZ

Tauranga hosted a gathering of clubs at their open weekend in March. Clubs from all over the North Island were represented as well as one member from Blenheim in the South Island. There were 31 operating locomotives, 5 under construction and one traction engine, a 1½" scale Allchin. Of the running locos, 8 were 3½", 14 were 5" and the remainder 7¼".

This is another club looking at security alarms as a result of a break-in. Meetings have been dominated by the proposed track extension which will take about twelve months to complete.

Tauranga Model Marine and Engineering Club
Location: Memorial Park, Tauranga
Public Running: Every Sunday

Hobart Tas

The AGM was held at the track-site on 30 March. New office bearers for 96/97 are:

President; David Crisp,
Vice-president; Bill Whenn,
Secretary; Myles McGinniss,
Treasurer; Derek Sandle,
Committee; Mick Cooper and Les Curry.

Club membership is floating around 20 with plenty of room for new members who would be most welcome. We run 3½" and 5" gauge on a 220 m. elevated track which is in the planning stage of up-grading. Correspondence to 22 East Derwent Highway Lindisfarne 7015

Hobart Miniature Steam Locomotive Society Inc.
Location: Flagstaff Gulley Road Lindisfarne.
Public Running: Ist. and 3rd. Saturday of each month starting 1p.m.

Mudgee NSW

Maybe you are building, or hope to build a *Blowfly*, well then Mudgee is the place to be on the weekend of 10, 11 August. Come and enjoy another fun weekend,either just running and showing your locomotive, or take part in several trials for both driver and locomotive that will test your skills.

Morning/afternoon teas will be available, lunch on both days and a BBQ on Saturday evening. Some on-site facilities for camping and caravans, for any additional accommodation contact the Mudgee visitors Centre on (063) 725 875 but be early.

Runs commence Friday night. Don't forget to bring your boiler certificate, AALS rules apply. If you haven't got a *Blowfly* you are welcome to come and have a run with us over the weekend on our 1700ft of 3½" and 5" ground level track

Please let us know if you are joining us by registering early (1 August). Contact the organizing secretary John Oliver during business hours on (Fax and Phone number) (068) 45 2557 or after hours on (068) 45 2018. Postal Address: PO Box 310, Wellington., 2820.

Coming Events

20, 21 July
Guildford Model Engineering Society (UK)
International Model Steam Rally and Exhibition

Our annual Rally and Exhibition for 1996 will be of an International variety. In the past we have had visiting model engineers from most of the western European countries plus others from the USA, Australia, South Africa, Hong Kong and Japan. We are anxious to contact as many overseas visitors as possible to this popular event.

We shall offer hospitality for overseas visitors from Saturday 13 July and the whole week preceding the exhibition. An information pack will be forthcoming for any potential overseas visitors who may like to have details of accommodation around Guildford and details of the weeks programme.

Contact: John Jones. 282 Grange Road, Willow Park, GUILDFORD, Surrey, GU2 6QZ, UK

10, 11 August
Blowfly Rally — Mudgee NSW
Contact: John Oliver (068) 45 2018
((3½"g and 5"g gl track).

10, 11 August
AALS Vic Branch — Wodonga Vic.
Enjoy a weekend of model engineering and dinner on Sat evening. Accom booked if req. Contact the Lake Hume Model Engineers at PO Box 1017, Wodonga, Vic, 3698, for details. (3½"g and 5"g elev. 5"and 7¼"g. gl track.)

7, 8 September
14th Birthday run — Narara NSW
The Central Coast Steam Model Co-op Ltd invite everyone to share in their birthday party! Saturday, 11am - 4pm, running for the general public. Saturday evening, free barbeque for AALS visitors. Sunday, private running for AALS affiliated clubs. Morning/Afternoon teas and lunch, both days, provided free. Plenty of room for caravans or tents. Contact: Tom Winterbourne (043) 25 4838 for more details. (5"and 7¼"g. gl track.)

14 September
Interclub run — Prospect SA
The Adelaide Miniature Steam Railway Society at Regency Rd (off Maud St.) Prospect, welcome local and interstate model engineers to a great day of railway operations. Contact the Secretary, John Wakefield, (08) 362 3269 for further details. (5" gauge gl track only.)

28, 29 September
Canberra Invitation Run
Come to Canberra for steam and flowers during the Floriade! Contact: Peter Hately (06) 254 7229. (2½" and 3½"g. elevated, 5"and 7¼"g. gl track.)

5, 6 October
3rd Model Engineering Exhibition
Monash University, Melbourne. Join the fun and spread the word about our great hobby to an appreciative audience at this year's exhibition.
Exhibitors Wanted Contact:
Robert Jones (03) 9801 6048.

5, 6, 7 October
Inter-club run — Port Augusta SA
Enjoy the long weekend with the Port Augusta Model Engineers. Contact Ernie Riding at 10 Butler Close, Port Augusta, SA, 5700 or phone (086) 423858.

11, 12, 13 October
Annual Steam Festival — Hornsby Model Engineers
Enjoy a relaxing weekend of steaming in bushland at Galston, just on the north-western edge of Sydney. Large display of members' work plus operational stationary engines. (3½"g and 5"g gl track).

12 October
AALS Vic Branch — Eltham Vic.
The Diamond Valley Railway is host for the day. Contact the President on (03) 9435 4685 for details.

19, 20 October
8th Miniature Traction Engine Rally
Inverell Pioneer Village, Inverell, NSW. Contact: Gordon Blake (067) 22 4277.

2, 3 November
SASMEE Park 50th Anniversary
SASMEE are celebrating their 50th year at SASMEE Park by holding a commemorative exhibition. Still being arranged. Details from Secretary., Ian Clark, PO Box 208 Goodwood. SA 5034.

2, 3 November
Invitation Run — Wagga Wagga NSW
Come and join in the annual get-together and hospitality of the WWSME. The traction engine track is now operational so come and try it out! For further details contact: David Font, (069) 21 4762.

22, 23 February 1997
5th Annual Invitation Run
Lake Macquarie LSLS 45th birthday.

Edgeworth Birthday Celebrations

by Ross Edmondson

Photos by Peter King

On Saturday 24 February 1996, the Lake Macquarie Live Steam Locomotive Society celebrated their 43rd Birthday. There were 155 registered visitors with 68 Lake Macquarie club members. Couple this with 55 locomotives and you will get some idea of what it was like!

At the 2pm opening ceremony Club President, Tom Burns, welcomed all of the visitors to the Edgeworth complex. His Worship the Mayor of Lake Macquarie City, John Kilpatrick, welcomed the visitors to the City before officially declaring the weekend open. Tom called Kevin Bruderlin, Ray Cartwright, Dallas King and Frank Thompson to come forward. Joe Huntley presented the four members with Life Membership to the club — all had been with the club for over thirty years! Congratulations to these four gentlemen on receiving this prestigious award.

Councilor Jack Adams, also from the Lake Macquarie Council, was called upon to present an award to club member of the year from the Ladies Auxiliary and when Una Boyce heard her name called she couldn't believe it!

Tom Burns presented an award to Club Member of the year — Howard Civill. Howard, was thanked for his efforts with club activities.

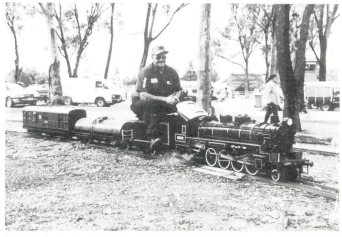
52 years on...

Lieutenant Colonel Richard Filewood from the Army Reserve was on-hand to make a special presentation to an "old soldier". He began... "Would NX 127188 Private Les Lamb come forward please".

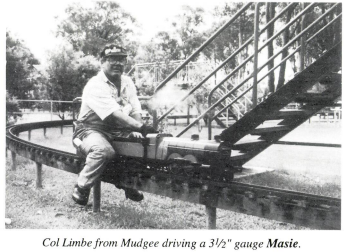
A somewhat bewildered Les made his way towards the official party where he recognized the rank of Lieutenant Colonel and immediately caught everyone off-guard when he saluted the Colonel! He sure did snap to attention! The Colonel paid a glowing tribute to Les who had served his time, with thousands of others, in the New Guinea campaign at the Markham Rumu Valley and Moratai Island, which is now know as Indonesia. Near the end of the war Les applied for a new hat as the one he had was a little battle-scarred — his request was denied. Les returned to civilian life with his battle-scarred slouch hat and over the years "the hat" gradually got to the "beyond repair" stage! Apart from the sides and the brim, fellow club members used to say that the only thing that stopped the hat from falling over his eyes were his ears!

It was through the efforts of Rod Scaife — stirring the pot, rattling the chains and making himself heard in the halls and corridors of Canberra that allowed the following event to take place.

Lt. Colonel Filewood remarked of the many countless stories, just like this one, that could be told if only the authorities knew of them. He then presented Les with a new slouch hat. It was apparent that Les was also over-awed by it all and said that the original hat was a 1944 issue, making it just on 52 years old. Les commented that it had seen better days. He went on to thank the Lt. Colonel for the replacement hat, the Army, and his fellow club members for making it all happen.



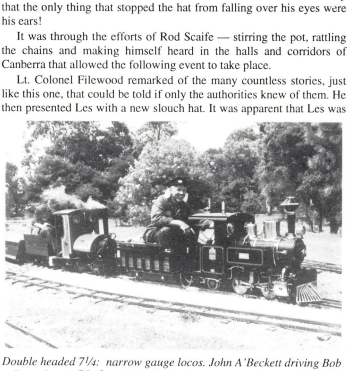
Host club member Lyle James driving his 7¼" gauge NSWGR 59 class loco with the water gin and PHG guards van.



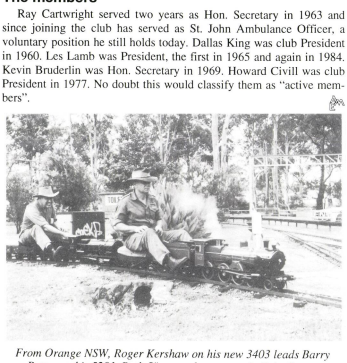
*Col Limbe from Mudgee driving a 3½" gauge **Masie**.*

The members

Ray Cartwright served two years as Hon. Secretary in 1963 and since joining the club has served as St. John Ambulance Officer, a voluntary position he still holds today. Dallas King was club President in 1960. Les Lamb was President, the first in 1965 and again in 1984. Kevin Bruderlin was Hon. Secretary in 1969. Howard Civill was club President in 1977. No doubt this would classify them as "active members".



*Double headed 7¼: narrow gauge locos. John A'Beckett driving Bob Rottenbury's **Linda** with Wally Brunyee following on his **Gaston**.*



From Orange NSW, Roger Kershaw on his new 3403 leads Barry Potter on his 5201. Both 5" gauge locos were built by Barry.

A Footplate Ride with George Stephenson

A letter to a friend

This delightful letter extends the theme of early railway history created by our lead article on ***Hardwicke****.*

In August 1830, Frances (Fanny) Kemble was playing at a Liverpool theatre. This famous niece of Sarah Siddons married a Philadelphian and fought for the emancipation of the slaves in Georgia. Frances managed to break her tour to return for the opening of the Liverpool and Manchester Railway by the Duke of Wellington. She described the occasion in another letter.

Frances displays an advanced grasp of mechanical contrivances for the era... ed

LIVERPOOL, August 26th, 1830.

My dear Harriet,

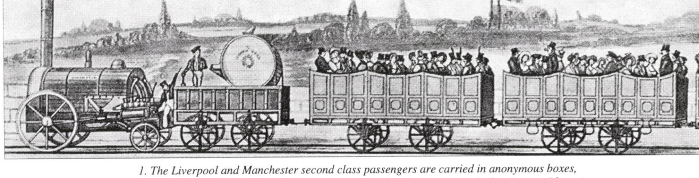
A common sheet of paper is enough for love, but a foolscap extra can only contain a railroad and my ecstasies. There was once a man born at Newcastle-upon-Tyne, who was a common coal-digger; this man had an immense constructiveness, which displayed itself in pulling his watch to pieces and putting it together again; in making a pair of shoes when he happened to be some days without occupation; finally — here there is a great gap in my story — it brought him in the capacity of an engineer before a Committee of the House of Commons, with his head full of plans for constructing a railroad from Liverpool to Manchester. It so happened that to the quickest and most powerful perceptions and conceptions to the most indefatigable industry and perseverance, and the most accurate knowledge of the phenomena of nature as they affect his peculiar labours, this man joined an utter want of the "gift of the gab"; he could no more explain to others what he meant to do and how he meant to do it, than he could fly, and therefore the members of the House of Commons after saying "There is a rock to be excavated to a depth of more than sixty feet, there are embankments to be made nearly to the same height, there is a swamp of five miles in length to be traversed, in which if you drop an iron rod it sinks and disappears; how will you do all this?" and receiving no answer but a broad Northumbrian, "I can't tell you how I'll do it but I can tell you that I *will* do it," dismissed Stephenson as a visionary. Having prevailed upon a company of Liverpool gentlemen to be less incredulous, and having raised funds for his great undertaking, in December of 1826 the first spade was struck in the ground.

And now I'll give you an account of my yesterday's excursion. A party of sixteen persons was ushered into a large court-yard, where under cover, stood several carriages of a peculiar construction, one of which was prepared for our reception. It was a long-bodied vehicle with seats placed across it back to back; the one we were in had six of these benches, and it was a sort of uncovered *char à banc*. The wheels were placed upon two iron bands, which formed the road, and to which they are fitted, being so constructed as to slide along without any danger of hitching or becoming displaced, on the same principle as a thing sliding on a concave groove. The carriage was set in motion by a mere push, and, having received this impetus, rolled with us down an inclined plane into a tunnel, which forms part of the entrance to the railroad. This tunnel is four hundred yards long (I believe), and will be lighted by gas. At the end of it we emerged from the darkness, and, the ground becoming level, we stopped. There is another tunnel parallel with this, only much wider and longer, for it extends from the place we had now reached, and where the steam carriages start, and which is quite out of Liverpool, the whole way under the town, to the docks. This tunnel is for wagons and other heavy carriages; and as the engines which are to draw the trains along the railroad do not enter these tunnels, there is a large building at this entrance which is to be inhabited by steam engines of a stationary turn of mind, and different constitution from the travelling ones, which are to propel the trains through the tunnels to the terminus in the town, without going out of their houses themselves. The length of the tunnel parallel to the one we passed through is (I believe) two thousand two hundred yards.

I wonder if you are understanding one word I am saying all this while?

We are introduced to the little engine which is used to drag us along the rails. She (for they make these curious little fire horses all mares) consisted of a boiler, a stove, a platform, a bench, and behind the bench a barrel containing enough water to prevent her being thirsty for fifteen miles, — the whole machine not bigger than a common fire engine. She goes upon two wheels, which are her feet, and are moved by bright steel legs called pistons; these are propelled by steam, and in proportion as more steam is applied to the upper extremities (hip joints I suppose) of these pistons, the faster they move the wheels; and when it is desirable to diminish the speed, the steam, which unless suffered to escape would burst the boiler, evaporates through a safety valve into the air. The reins, bit, and bridle of this wonderful beast, is a small steel handle, which applies or withdraws the steam from its legs or pistons, so that a child might manage it.

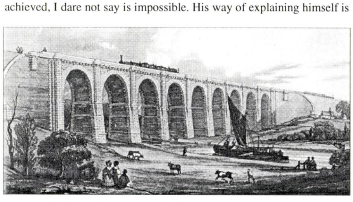
"The coals, which are its oats, were under the bench, and there was a small glass tube affixed to the. boiler, with water in it, which indicates by its fullness or emptiness when the creature wants water, which is immediately conveyed to it from its reservoirs. There is a chimney to the stove, but as they burn coke there is none of the dreadful black smoke which accompanies the progress of a steam vessel. This snorting little animal, which I felt rather inclined to pat, was then harnessed to



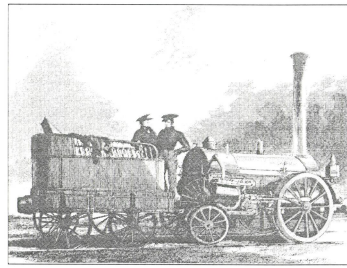
1. The Liverpool and Manchester second class passengers are carried in anonymous boxes, hauled by the ***North Star*** *of the already obsolete Rocket class (as described in Frances' letter).*

our carriage, and Stephenson having taken me on the bench of the engine with him, we started at about ten miles an hour. The steam horse being ill adapted for going up and down hill, the road was kept at a certain level, and appeared sometimes to sink below the surface of the earth and sometimes to rise above it. Almost at starting it was cut through the solid rock, which formed a wall on either side of it, about sixty feet high. You can't imagine how strange it seemed to be journeying on thus, without any visible cause of progress other than the magical machine, with its flying white breath and rhythmical, unvarying pace, between these rocky walls, which are already clothed with moss and ferns and grasses; and when I reflected that these great masses of stone had been cut asunder to allow our passage thus far below the surface of the earth, I felt as if no fairy tale was ever half so wonderful as what I saw. Bridges were thrown from side to side across the top of these cliffs, and the people looking down upon us from them seemed like pygmies standing in the sky. I must be more concise, though, or I shall want room. We were to go only fifteen miles, that distance being sufficient to show the speed of the engine, and to take us to the most beautiful and wonderful object on the road. After proceeding through this rocky defile, we presently found ourselves raised upon embankments ten or twelve feet high; we then came to a moss or swamp, of considerable extent, on which no human foot could tread without sinking, and yet it bore the road which bore us. This had been the great stumbling-block in the minds of the committee of the House of Commons; but Mr. Stephenson has succeeded in overcoming it. A foundation of hurdles, or, as he called it, basket-work was thrown over the morass, and the interstices were filled with moss and other elastic matter.

"Upon this the clay and soil were laid down, and the road does float, for we passed over it at the rate of five and twenty miles an hour, and saw the stagnant swamp water trembling on the surface of the soil on either side of us. I hope you understand me. The embankment had gradually been rising higher and higher, and in one place where the soil was not settled enough to form banks, Stephenson had constructed artificial ones of woodwork, over which the mounds of earth were heaped, for he said that though the woodwork would rot, before it did so the banks of earth which covered it would have been sufficiently consolidated to support the road. We had now come fifteen miles, and stopped where the road traversed a wide and deep valley. Stephenson made me alight and led me down to the bottom of this ravine, over which, in order to keep his road level, he has thrown a magnificent viaduct of nine arches, the middle one of which is seventy feet high, through which we saw the whole of this beautiful little valley. It was lovely and wonderful beyond all words. He here told me many curious things respecting this ravine; how he believed the Mersey had once rolled through it; how the soil had proved so unfavorable for the foundation of his bridge that it was built upon piles, which had been driven into the earth to an enormous depth; how while digging for a foundation he had come to a tree bedded in the earth, fourteen feet below the surface of the ground; how tides are caused, and how another flood might be caused; all of which I have remembered and noted down at much greater length than I can enter upon here. He explained to me the whole construction of the steam engine, and said he could soon make a famous engineer of me, which, considering the wonderful things he has achieved, I dare not say is impossible. His way of explaining himself is



3. The viaduct across the Sankey Valley, Lancashire.



2. The Northumbrian engine, built for the Liverpool and Manchester in 1830, and the final development of the Rocket class.

peculiar, but very striking, and I understood, without difficulty, all that he said to me. We then rejoined the rest of the party, and the engine having received its supply of water, the carriage was placed behind it, for it cannot turn, and was set off at its utmost speed, thirty-five miles an hour, swifter than a bird flies (for they tried the experiment with a snipe). You cannot conceive what that sensation of cutting the air was; the motion is as smooth as possible, too. I could either have read or written; and as it was, I stood up, and with my bonnet off "drank the air before me". The wind, which was strong, or perhaps the force of our own thrusting against it, absolutely weighed my eyelids down.

"When I closed my eyes this sensation of flying was quite delightful, and strange beyond description; yet strange as it was, I had a perfect sense of security, and not the slightest fear. At one time, to exhibit the power of the engine, having met another steam-carriage which was un-supplied with water, Mr. Stephenson caused it to be fastened in front of ours; 'moreover, a wagon laden with timber was also chained to us, and thus propelling the idle steam-engine, and dragging the loaded wagon which was beside it, and our own carriage full of people behind, this brave little she-dragon of ours flew on. Farther on she met three carts, which, being fastened in front of her, she pushed on before her without the slightest delay or difficulty; when I add that this pretty little creature can run with equal facility either backwards or forwards, I believe I have given you an account of all her capacities. Now for a word or two about the master of all these marvels, with whom I am most horribly in love. He is a man from fifty to fifty-five years of age; his face is fine, though careworn, and bears an expression of deep thoughtfulness; his mode of explaining his ideas is peculiar and very original, striking, and forcible; and although his accents indicates strongly his north country birth, his language has not the slightest touch of vulgarity or coarseness. He has certainly turned my head. Four years have sufficed to bring this great undertaking to an end. The railroad will be opened upon the fifteenth of next month. The Duke of Wellington is coming down to be present on the occasion, and, I suppose, what with the thousands of spectators and the novelty of the spectacle, there will never have been a scene of more striking interest. The whole cost of the work (including the engines and carriages) will have been eight hundred and thirty thousand pounds; and it is already worth double that sum. The directors have kindly offered us three places for the opening, which is a great favour, for people are bidding almost anything for a place, I understand!

Yours, Frances Kemble

Acknowledgments:

Letter submitted by Colin Wear.

Letter from: R.Pike, *Railway Adventures and Anecdotes.* 1884.

Illustrations 1 and 2, courtesy of: J.B.Snell *Early Railways*, Octopus Books, London, 1972. Illustration 3 by courtesy of Howard Loxton, *Railways*, Hamlyn, 1968.

Repairs to Locomotive Boilers on the Victorian Railways

Boiler Patches

by Doug Baxter

Firstly let us look at various types of patches to both wagon-type and Belpaire-type boilers with copper fireboxes. Due to the long life of copper fireboxes, particularly in the smaller size boilers, there developed areas of pitting in the bottom area of the leading barrel. This no doubt was due to the delivery of the feed water which travels from the injector located on the back plate along the injector delivery pipe which is clipped to the barrel sides at about the side centre line. When it is about four feet from the smokebox, the pipe dips down at about 45 degrees, finishing about two feet from the smokebox tubeplate, where the end is squashed to form a duck-bill end. When these lighter engines were working on outer branch lines, the supply of water was usually from a dam situated on high ground and reticulated to the station holding tank and it was these impurities that caused this pitting.

Pitting

Pitting varied in depth up to 50% of barrel thickness in small areas to 25% over large areas, and was in the bottom two feet of the barrel. At the end of the third period life of the boiler — about 14 years — and with the copper fire box in good condition, all the tubes removed for internal examination. This necessitated the removal of several longitudinal stays for ingress through the dome to locate the wastage. The smokebox tubeplate rivets were drilled out and the plate removed to give access to this area. The area to be covered by the barrel line was thoroughly cleaned of all scale and sediment.

Barrel liners were ⅜" thick. The ends were planed square to the exact length from the end of the lap seam of the trailing barrel and the barrel angle ring to which the smoke box tube plate is riveted, the longitudinal edges were planed to a 45 degree angle with a ⅛" landing, and the plate was set to the correct inside radius of the barrel.

When placed in position, the 45 degree angle along the sides did not allow a build-up of residue. The liner was held in position by a single row of rivets, all round and spaced at about 6" pitch.

Using suitable lifting equipment the boiler could be placed over the hydraulic gap riveter. Before the patch was finally placed in position for riveting, the area to be covered was given a coating of red lead; in conjunction with the pressure of the hydraulic riveting this formed a watertight seal.

Due to the rigidity of the fire box, particularly along the seams of the inner wrapper and the flanges of the tube and fire hole plates, the breathing of the boiler took place in the centre of the flanges of the throat and back plates. This constant movement eventually developed cracks in the knuckle of the throat plate — the area from the side centre-line to the waist, that is where the throat plate narrows in to drop down between the frame. They also occurred in the side flanges of the back plate, anywhere from top to bottom, and in Belpaire type boilers across the top of the throat plate.

Running repairs

These cracks started to develop after about 10 years. Once started they continued until they showed through on the outside as a blow of steam about an inch long, usually starting to blow when the boiler was at full working pressure. This blow would be noticed by the running-shed boilermaker, who would report it to the depot foreman who in turn would notify the foreman boilermaker at Newport, where the engine was to be taken for repairs. The running-shed boilermaker would stamp a rough-faced tool along the length of the crack to temporarily stop the blow of steam. The engine would be worked back with a light load, usually about 300 tons, and as it passed through any location which had a running shed boilermaker, he would be informed. After inspecting the crack he would give it further treatment if necessary with the rough tool. I assume that since the noticing of the blow, a section of cladding would have been removed to expose the crack.

Making a patch

Patches to cover these sections of throat plates and back plates were pressed from plate the same thickness as the outer wrapper, and they fitted the contour of the plate about 95%. Although the blow was about 1" long, from experience it was known that the grooving on the inside would extend up to 12". Thus the patch would be made about 18" long.

The procedure was to mark out with chalk the estimated area of the proposed patch, transfer it to the patch material, then add 1" all around — except to the edge that was to butt up to the outer wrapper, which would be a tight fit to the wrapper plate. All cutting was done with oxy-acetylene gas. As the patch was to be finally applied with button studs (similar to the replacement of rivets) undersized holes were drilled along the edge of the outer wrapper at the correct pitch and matching pitch holes were drilled along the edge of the patch about ⅛" further out from the edge of the patch, as draw holes.

Assuming the boiler was still in the frame of the engine, it would be necessary to remove the foot plate and maybe various other minor fitting to give access to work. In this case the work would be done in the Erecting Shop — usually out the front under what was known as the canopy, there being plenty of room for the location of a large portable coke fire, and staging from which to work.

Applying the patch

The patch was heated to a blood red on the coke fire. With bolts with wire attached protruding from the holes, the patch was applied and drifts driven in the draw holes, forcing the edge of the patch up hard against the outer wrapper. With the aid of fullers and flatters, the whole area of the patch was laid tight down on the throat plate. It would be further held in position by the use of heel washers attached to various studs on the boiler. A good hammers-man laid on the fuller and flatter with a seven-pound flogging hammer. The patch was then removed and trimmed to the required finished size. The draw holes would be opened up to take larger bolts, then the patch would be heated again and re-applied with any further use of fuller and flatter as necessary.

Stud location

The locations of the button studs along the outer edge of the patch were then marked and drilled. The patch was again removed, a welding bevel was chipped on the outer wrapper for the length of the patch and ground on the corresponding edge of the patch, and the remaining edges were ground to a caulking bevel. The patch was again heated to a blood red and a bolt applied to every second hole — and if necessary the edges between the bolts were further closed down.

The holes without bolts were opened to the correct tapping size and countersunk to suit the button studs. They were tapped and the studs were applied, and the bolts were removed. The remaining holes were opened up, countersunk and tapped. Button studs were applied, the edges of outer wrapper and patch welded and the edges of the patch were caulked. The button studs, after being screwed up as tight as possible, had the square re-

moved, then were pegged down and whipped in.

The boiler was then subjected to a hydraulic test followed by a steam test to prove the work. When patches were applied to the crown of the throat plate, they were known as double crown patches as one was put on either side of the top centre-line. Then they were welded together along the top centre as well as to the outer wrapper. If when applied to the back plate they went down below the waist, they were applied in two sections and were welded at the joint. These applications of patches would take two weeks. If cracks were discovered when the tubes were removed for an internal examination, the boiler would most probably be in the boiler shop. A thinner patch, usually ⅜" thick, would also be applied inside in addition to the one outside — and in this case rivets would be used instead of button studs.

Experimentation of procedure

When the scrapping of a larger number of engines commenced about the late 1950s the boilers were also cut up. The sections subject to cracking were removed and experiments carried out on gouging the cracks from the outside and welding up. The gouging was carried out with the air arc grooving tool — A 12" long stick of ¼" diameter carbon with a thin copper coating to give it rigidity. Applied to a holder and used in lengths from 2 to 6 inches, the holder had two air holes about 1/16" diameter about ¼" apart. The current used was DC and about 200 amps. An air line was also connected to the holder at a pressure of about 100 psi. At the moment of touching the plate with the carbon electrode causing an arc, the air lever was pressed and the jet of air blew the molten metal clear. As long as the operator continued to keep the arc maintained and the jet of air flowing, the tool continued to cause a neat groove. Considering this action was only about ⅛" long at the initial striking of the arc, the operator had more control of the groove than with an oxy-acetylene gouging tool.

The electrodes used were the low hydrogen type. When the metal is split to atoms by the arc the molecules of steel form before the molecules of hydrogen — from the atmosphere — thus atoms of hydrogen are trapped between the molecules of steel but eventually form molecules by forcing themselves between the molecules of steel forming cracks. Bear in mind that this all takes place at the size of a fraction of a pin's head, so the less hydrogen available at the source of the weld the better.

Easing stress

To reduce the amount of tension in the weld, the engines were required to arrive at workshops with a full head of steam. The fire was dropped and the boiler blown down until the water was below the anticipated bottom of the crack. As soon as pressure was gone, the operator using the air arc grooving tool started to vee the crack until full solid plate was obtained. Immediately this was done another operator commenced to apply the root run. The gouging operator had now converted his machine back to conventional arc operation and in conjunction worked non-stop. When the second run was completed, the boiler was connected to the shop's stationary boiler and — through the injector — feed water was fed into the boiler. While this was going on, arrangements were made to relight the fire as soon as half a glass of water was obtained. With the weld about 75% completed, pressure began to show on the gauge, and at the completion of the welding the boiler had a full head of steam.

This procedure proved correct, as these boilers saw the remainder of their life without further cracking. Cracks were done in throat plate knuckles and crowns, but were never done on back plates as the occasion never arose. This operation was carried out in a way that the engine was only out of service for about eight hours.

Copper firebox patch

On very rare occasions it was necessary to apply a patch to a copper fire box inner wrapper due to a crack developing between stays in the hot spot area. The area of plate to be removed was marked out in an oval shape, locally known as a "football patch" (Victorian football). The reason was that it was necessary to apply copper firebox patches on the water side; if they were applied on the fire side, the protruding copper would take up the heat very rapidly when the fire was lit and would lift away from the inner wrapper and consequently leak. Being oval, the patch could be inserted by the minor axis going through the major axis and turned around.

These patches were applied with copper studs as used to replace rivets down the legs of flanges in fire boxes. The stud holes were drilled and a T-headed bolt placed in every hole and pulled up tight. One bolt at a time was removed, the hole tapped and the stud applied with three threads on both side protrudin. The stud was then knobbled over, pegged down and whipped in; this was continued till studs were in place. The edges of the plate were then staved to the patch and lightly caulked.

It was necessary to remove the cracked material with pneumatic chisels, as this was the only way. On similar occasions, cracks occurred in the flanges of copper tube plates and fire hole plates, necessitating the designing of an intricately shaped patch which was on the water side but with a flange on the fire side, to accommodate the studs to replace the rivets. This necessitated scarfing down the plate flange to obtain a satisfactory joint.

Steel firebox with flex stays

With the introduction of steel fire boxes with flexible stays, there was no cracking in knuckles, crowns or flanges of back plates. The main patches to fire boxes of all-steel boilers were half sides — that is, from above the first row of stays above the foundation ring to above the hot spat (which was about five stays up at the fire hole plate end, running horizontal to the tube plate — or in the case of combustion chambers to the flange of the throat plate).

The two main points in applying half side patches to all steel boilers are allowing for the weld contraction and keeping the edges of the patch in line. The first was achieved by fitting the patch at the top edge with a single vee of 70 degrees, with both a 1/16" landing and gap; and also on the longest end, that is the tube plate or throat plate. The other edges were to be a tight fit to the plate, and when these welds were complete it was usual for the shrinkage to have opened up a gap at both the bottom and the short end (Shrinkage allowed for hand welding was 6% of the cross section of the weld and increased as the number of runs). This procedure helped to eliminate the stress in the weld. The plates were kept in line by removing the row of stays surrounding the patch with a slack stay in alternate holes and a long bolt in the other. A similar procedure was applied to the patch, except that the slack stay was pushed against the patch (stay holes at this stage were drilled undersize) and the long bolt pulled the plate in to line. When the top and end welds were completed, the bottom and other edge were prepared in a similar manner and then welded.

Conclusion

When welding was complete, all slack stays and bolts were removed and the stay holes tapped as in the repair method, or as for new stays. An essential point when fitting half sides was to form a radius of about ½" at the corners to facilitate a good weld. Depending on the type of boiler, it was sometimes necessary to apply a few slack stays and long bolts in the centre area to prevent bulging or buckling.

In the previous article, Rivet Replacement *(AME Issue 66, page 51) it was mentioned that re-caulking a steam leak in the firebox above the foundation ring would be carried out by a fitter. This is not the case: the repair would be carried out by the running-shed boilermaker. This was AME's error, not Doug Baxter's. There was also a typographical error on page 52 just above Figure 5: the riveting hammer is 5lbs, not 55lbs as stated...ed*

Olympia Model Engineering Exhibition

An Oz Perspective by Leigh Adams

The long flight from Heathrow to Sydney seemed the perfect opportunity to write for AME, with the three days spent at the Model Engineering Exhibition 1995-96 held at Olympia London still fresh in my memory. This is the first time both my mate Ray and I have had the opportunity to attend such a large model expo. We arrived in London on the first day of the show, no time was lost making our way to the exhibition halls and for those who have never been — it is a fantastic venue, the main auditorium is huge!

Enthusiasm for modelling of just about anything is definitely popular in Europe. Within minutes of the doors being opened to the public, the aisles were soon packed and a dull roar of conversations filled the air. Exhibitors, both commercial and societies, had been hard at work prior to the opening filling their stands with stock and models of all shapes and sizes (or should I say *scale*).

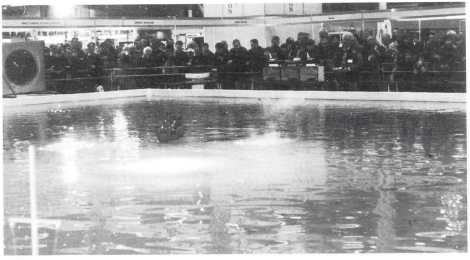
The first day was spent browsing around taking photos and familiarizing ourselves with the enormity of the layout. Both static and active exhibits soon filled the day and they ushered us out right on closing time. That night was spent thumbing through brochures and catalogues and discussing what was on the shopping list for the next day.

On day two we arrived early to beat the crowds — but 2,000 modellers had the same idea! So we queued, paid our £7 entry fee, and quickly moved inside the hall. Demonstrations were underway all around the hall.

Model boat pond

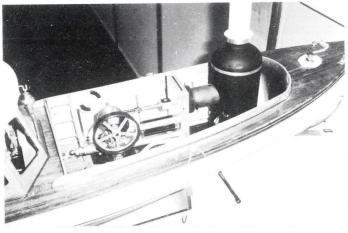
A man-made above-ground pool had been erected in the centre of the hall and was a hive of activity, with a full day's schedule allocated to electric, steam and sailing vessels. A demonstration between a flower class minehunter and a submarine shocked the crowd with exploding depth chargers making the unsuspecting jump when activated. Most of the

Olympia exhibition hall.



A flower class minehunter and a submarine in mock battle.

*The crew of the **Britannia** preparing to sail.*



A novel approach to marine power. This model pleasure launch is powered by a hot air engine!

model boats were between two and four feet long, mainly to suit the size of the pond: larger vessels were on static display. Two of the outstanding models for steam buffs were the *Bat* and an unknown model shown in the photographs. Finish and attention to detail was reflected with both winning medals in their category. The boating fraternity was well represented at the show and was well on a par with the locos and traction engines.

Model aircraft

Indoor flying introduces a whole new meaning when the hall dimensions restrict flight and the steel beams are very hard. Free flight, control line and radio control were put to the test and in the three days we attended no accidents, but plenty of spectacular and skilful flying. Radio controlled helicopters have always fascinated me and in the hands of these operators, for me stole the aircraft division of the show. Again large numbers of static displays support the aircraft division.

Ground transport

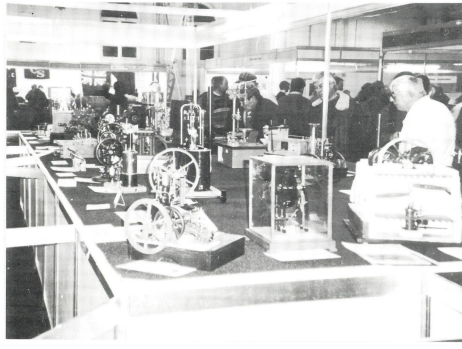
Steam locomotives, traction engines, steam vehicles and experimental engines everywhere you looked from the very, very small to ¼ scale traction engines in what Ray calls "hernia gauge". Engines of every shape, design and scale, working and static consumed the onlookers. You could see the cogs turning as visitors questioned the owners on technical and practical ways to get started on how to complete their projects. Clubs and societies had gone to great lengths to assemble and display varieties of work from their workshops. The combined enthusiasm created what one would call a *Model Environment.*

Trade displays

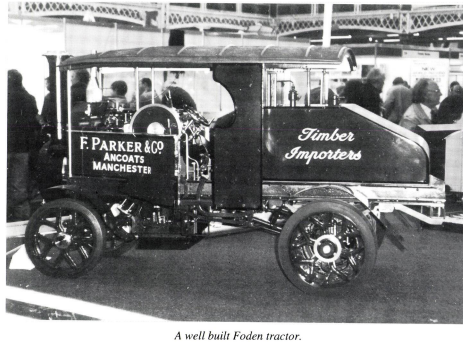
Commercial suppliers displayed tools, kits and stock materials of every shape and form. Brisk trading continued throughout the show and modellers left with some very heavy bags. Need I say any more!

Day three, time to give the travellers cheques and plastic a bash. Both Ray and I had planned to buy some castings and bits and pieces, but you can't let a bargain go by, so there's a few extra little things to squeeze in the bag on the way home. Won't matter (excess baggage — what's that?).

26,000 miles is not that far to go to a model show is it? (Yes dear!)



Engines of every shape, design and scale, working and static consumed the onlookers.



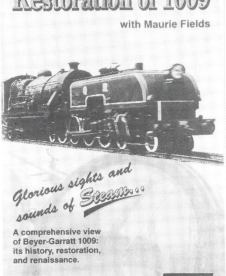
A well built Foden tractor.

There was a strong rail presence at the exhibition.

This 5" gauge train provided rides the whole time — and there was always a queue!

Product Reviews

Restoration of 1009



Beyer Garratt 1009 4-8-2 + 2-8-4. This video tape has two great things going for it firstly it is narrated by the late Maurie Fields, a great Australian and comedian, secondly it was made by Queensland Railway's Heritage Division.

This tape is very well produced. The opening sequence features the original Beyer Peacock promotional film made for the QR. This is followed by early footage of the Garratt being unloaded at the docks in Brisbane. Other scenes show 1009 at the old museum at Redbank, and its subsequent removal for restoration — it's not every day you see a Garratt locomotive rolling down the road on an escorted low-loader!

The video shows the arrival at the Ipswich workshop and dismantling starts — with some very good views of the inner workings of a Garratt's front tank. The film of the driving unit shows the machining of the driving wheels and the ingenious way the machinist overcomes problems the same way model engineers do. Its a also shows the time-honoured way of fitting tyres to wheel rims. It also shows some of the many hundreds of parts that go to make up a steam locomotive of this calibre — the same as we have to do it!

The film highlights the skills and craftsmanship of days-gone-by. The mould seen in the video is for the blastpipe in the smokebox — some 670 new castings were made for the restoration! The video shows many of the steam-age skills — sadly, almost gone.

It never ceases to amaze me how similar both full-size and miniature look at the various stages of building. The views from the overhead crane give a good idea as to the problems that go with the restoration of an articulated locomotive. When the engine units are wheeled it shows that, with care and patience, things go together much easier. When the engine is back together it looks a thing of beauty — it never ceases to amaze me that when you take steam engine out for a test run the number of people who know when your'e out. When the Garratt goes for test run to Laidety, west of Brisbane, with seven coaches it looks like a million dollars — a Garratt in full flight is something to see — with all the rods and motions dancing. The final scenes show the 1009 on one of the many trips to outback of Queensland to celebrate QR's 130th anniversary. The Queenslander's comments say it all: the quality of workmanship that was performed on 1009.

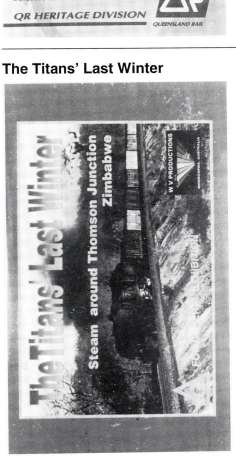
Maurie Fields' narration is both clear and informative. This is an excellent tape for the railfan and model engineer alike.

Restoration of 1009

Available from Brisbane Railway Films
C/o Brian Witte
PO Box 1662 Fortitude Valley Qld 4006
Ph (07) 3892 3504
Price $39.95 plus $4.00 for postage in Aust.

Mark Carney

The Titans' Last Winter



This tape is well produced for an amateur production. It opens with a map of Zimbabwe and short explanation of the purpose of the video. Then you see Garratt's being prepared for duty in the shed and on the ready track.

The video features nearly all Garratts of the 15th, 16th, 20th and 20A class built by Beyer Peacock. It shows one of the 15th class shunting Thomson Junction. Also shown is a 20A class, weighing 223 tonnes (not much smaller than the NSWGR 60 class), No.747 and called *Jumbo* for obvious reasons. The scene shows the 4-8-2 + 2-8-4 heading through the scrub followed by a 15th class 4-6-4 + 4-6-4 weighing 197 tonnes.

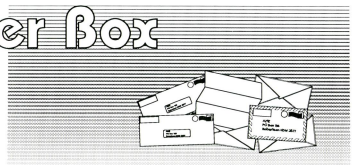
The viewer is kept updated with numbers within each class including rebuilds and numbers that are left for historical tours and safaris. It's nice to see steam engines working without all the whistling that is heard in some videos. A scene with Victoria Falls features 15th class Garratts heading for the main shed of Bulawayo in the early morning — with steam coming every joint possible! We are treated to a cab ride in 15th class 372 for a run to TJ, it's always amazing to see how these men can work in dirty and dusty cabs in clean light coloured shirts without getting dirty! A visit to the workshop of The National Railways Of Zimbabwe before joining a tour across the country with various classes of Garratts including a 20th class (dubbed the Big Boys). The arrival at the "small colonial style" Victoria Falls station with its beautiful gardens is followed by a light aircraft flight over one the seven wonders of the world. The workshops of Zeco were the titans are refreshed, here we see Garratts of all types being repaired in the final scenes we visit Bulawayo yard at sundown with Garratts being shunted to different roads in the shed the scenes inside the running shed are timeless and universal no matter were in the world you may travel to. running time 48 minutes for lovers of articulated locomotives. The closing scene shows engines of Wankie Colliery, 19th class 4-6-2, working a top and tail arrangement.

The Titans' Last Winter Part One by W. V. Productions.

PO Box 141 Moorooppna VIC 3629
Price $39.95 plus postage.

Mark Carney

Letter Box



Sandfly reunites soldiers

Sir,

In your Sept-Oct issue of 1993 AME, you ran an article on the little locomotive the *Sandfly* used in Darwin: on seeing that issue I sent off to you some first hand information about *Sandfly*: As I mentioned our unit, the 140 AGT Coy, was stationed in Darwin from late 1941 to June 1943 and we serviced the wharves every day and night during that time, after the first Japanese air raid.

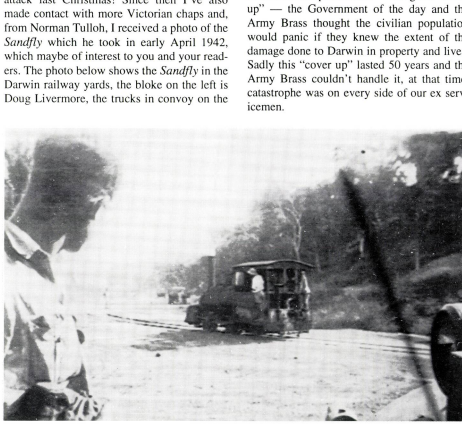
In response to AME publishing my comments in the Jan-Feb 1994 issue I received a letter from a dear army mate, Fred, I had not seen or heard from for 50 years. From Fred I made contact with two more old pals, John and Jack.

I met Fred on the *Australia Remembers* trip in Melbourne when the train trip which came from Sydney to Alice Springs and then to Darwin by truck arrived at Spencer St. (Melbourne) and it was such a great joy and pleasure to meet him after all these years and later exchange letters and photographs. Sadly Fred and Jack have since died of heart attacks and my number is on the hit list: I had a heart attack last Christmas! Since then I've also made contact with more Victorian chaps and, from Norman Tulloh, I received a photo of the *Sandfly* which he took in early April 1942, which maybe of interest to you and your readers. The photo below shows the *Sandfly* in the Darwin railway yards, the bloke on the left is Doug Livermore, the trucks in convoy on the way to the wharves are the 140 AGT Coy's, you will note the gap between trucks, this was to avoid the Japanese bombing.

Other photos Norman sent include: the rail car *Leapin Lena* with three of our blokes: Des Wilson, Ron Pitcher and Col Bradbury. Darwin Station with one of our modern steam engines dated 1885. The troop train on the way to Noonamah stopped at Adelaide River for a 'cuppa'. Troops travelled in cattle trucks, 30 to a truck with gear — no mattresses, just two blankets, and we never slept on one unless we went to hospital. This was the last part of the journey to Darwin, about 320 miles.

The rather wry thing about these photos was that they were all taken secretly! After the first raid on Darwin 19 February 1942. The army issued orders that cameras in possession of all personnel were banned and were to be confiscated along with photos, and the penalty — imprisonment! I was warned off by our Sergeant Major who suspected me — and rightly so!

Norman Tulloh, who took these photos, had a Brownie box camera and blithely went around 'popping the button' at his leisure. The reason for the prohibition — the great "cover up" — the Government of the day and the Army Brass thought the civilian population would panic if they knew the extent of the damage done to Darwin in property and lives. Sadly this "cover up" lasted 50 years and the Army Brass couldn't handle it, at that time, catastrophe was on every side of our ex servicemen.



Malaysia had just fallen and the loss of the 8th Division as POW's was massive for us and they did not want to hear about Darwin. There must be lots of old photos out there, which would shed light on this and other parts of our history.

Ray Lee
Victoria

Please consider the ladies

Sir,

So, another convention has been and gone and no doubt it will be acclaimed the best one yet by the manfolk. But what about the girls?

We do like to accompany our man to these, but when we get there, we invariably get bored stiff while the men are away talking with other men about all sorts of technical things or are away driving trains and we just sit and sit and sit and to rub salt into our wounds we also have to pay $10 per day for that privilege. So how about it, you organisers for these conventions? Could you spare a thought for us girls, and organise something to amuse ourselves as well, and I'm not talking about the proverbial bus trip.

To criticise and not offer any suggestions would not be good cricket of course, so for what it is worth and to set the ball rolling, what about some tables set aside for us in the hall or even a tent, where we can exhibit our hobbies and other ladies can admire or criticise what we are doing, so we can also have something to talk about among ourselves and can show others what we are doing and the way we do it.

I hope this will set the cat among the pigeons and invite some more suggestions or reactions from other ladies that participate in the conventions.

Jo de Jong
Victoria

A hard case

Sir,

I would appreciate it if you would publish the following letter in one of your future editions.

"Kasenit Case Hardening Compound"

Is there anyone out there in the model engineering community who can advise me of a source from which I can obtain a small quantity (to 1 kilogram) of Kasenit Case Hardening Compound?

I have been unable to locate a source in Australia. Earlier this year I wrote to an address for Kasenit in USA which had been published in an English Model Engineering magazine but have not had the courtesy of a reply.

Kevin Nunn
Queensland

Kevin, you could try a local product called ***Hardite*** *it does the same job as* ***Kasenit****... ed.*

News Desk

compiled by Brian Carter

Well — the last issue was a lot later than I expected. Coupled with my trip to South Australia, there was a distribution hitch that compounded the problem. Unfortunately it may take a couple of issues to catch up to the timetable again! Don't despair — we are still producing the magazine!

AME in NZ

I am disappointed at the overall response to AME in New Zealand. We began countersales in May 1995 and it has been consistently low. We envisaged at the time that it would be a twelve month trial period. In light of the latest sales figures, we are considering making the September-October issue the last available over-the-counter. Our present casual NZ readers might consider a direct subscription if they wish to continue receiving AME. I'll reconsider if there is enough "real" support.

Psyche Bend Pump

The article in the May-June 1996 AME quoted a few dates for viewing the pump in action. Some of these dates have been changed. You can see the pump operating during 1996 on: 28 July, 29 September and 3 November. During 1997 on 1 January, 26 January, 29 March and 8 June. The new address of the Sunraysia Steam Preservation Society is: PO Box 2633, Mildura, 3502, Victoria.

QSMEE Elevated Track

The article in the May-June 1996 issue of AME referred to the Mooroolbark track as the basis for the design. The QSMEE elevated track was actually based on the Moorabbin (Victoria) elevated track.

Readers requests

Every now and then we receive wish-list notes from readers. Can you make these wishes come true? John Elsol would like to see articles on how someone built an engine as Ray Lee and John Wakefield have done in the past. (John wasn't aware that his brother had submitted the *Hardwicke* story for this issue!)

Frank Delaney suggests that we should produce postcard or cigarette card size coloured photos of locomotives, tractors, stationary engines (and steam boats?) with the name on the front and details printed on the back. Frank suggests that the cards could be included with each issue of the magazine. An album could be sold separately for collectors.

Frank also suggests engineering-type data sheets for inclusion in each issue. Frank goes on to mention another wish, but it is already under preparation — I don't want to get everyone exited yet: I'll tell you what it is later in the year.

My wish is that I had the time to satisfy your wishes — If you agree with these gentlemen I'll accept volunteers to take on the projects suggested.

New club

The Mornington Peninsula (Victoria) will be alive with the sight and sound of 5" and 7¼" gauge trains if anyone is interested in forming a club in the area. Write to PO Box 45, Baxter, 3911, Victoria, for further information.

Club address change

Western Districts Live Steamers Co-op Ltd who operate at the Fairfield Showgrounds can be contacted by mail at:
PO Box 403, Mount Pritchard, 2170, NSW.

Information Super-railway

There are a lot of modellers on email these days! Thanks to all those who have dropped me a line over the electronic mail route.

News on the NET

Thanks to Joe Hovel and the Bendigo Society of Model Engineers, you can see the front cover of each issue of AME — before it is printed! The page also includes the list of contents and subscription information. You can also email me direct from the page. To check this out, connect to:
http://www.hitech.net.au/~jhovel/bsme.htm

When you are connected have a good look around the excellent Bendigo Live Steamers page and click on the *Australian Model Engineering* link.

Joe has established links to many live steam locations around the world — it's a great place to start a live steam journey on the Information Super-railway.

422 loco construction

We had to skip this issue of AME to allow more time for preparation for the final installment. Bill Abbott of Victoria has kept up with us and we intend to includc details of his Freight Rail Blue 42206 in the article. Our apologies for the inconvenience to constructors still battling on.

Ordering 422 numbers etc. Please allow a few weeks for us to prepare your order, each one is generated to suit the builder's requirements and it takes a bit of time to prepare — your patience is appreciated.

Historical news

David Mottram sent in a clipping about a 6" gauge railway called "Hales Creek Rail Road" that was in operation in Victoria around 1943 to 1952. The clipping includes a small amount of detail of the railway and three locomotives. We would be interested in hearing from anyone who remembers this railway and/or has photos of it or the locomotives.

David also included information about the Surrey Hills Live Steamers — also of Victoria. The club seems to be the same vintage as the Hales Creek Railroad. There is a list of 50 locomotives — as at 1952 there were 27 x 2½", 19 x 3½" and 4 x 5" gauge locomotives in the club. It would be interesting to see what became of the group. Does anyone know?

Trade and commercial

I had intended to review the MICRO POSITION SENSOR in this issue. The truth is that I have been having so much fun with it a short review is not enough space to really do it justice! It need a few pages! I am preparing an article, with mounting diagrams, photos and useful tips and tricks on how to get the best out of the sensor. If you can't wait, call (02) 449 4415 to order yours.

Phone number changes

A reminder that Sydney phone numbers change at the end of July. Add a 9 to the first numbers after the area code (02). My phone number will be (02) 9649 5301 and my Fax will be (02) 9646 1362

Don't panic — you'll have until January 1997 to get used to it. Mobile phone numbers remain the same.

Brisbane has already changed, add a 3 in front of the numbers after the area code (07).

Melbourne has also changed, add a 9 in front of the numbers after the area code (03).

Please adjust the numbers of the (03) and (07) area codes in the ads if they have not already been altered. There are so many of them it is taking me a while to get to them all.

Comments

Don't forget to take the opportunity to have your say by writing a comment for page 5 on how YOU enjoy model engineering. Apparently many people have given up the idea because I said it all! I just said what I felt — we are all different! I am sure you can come up with something original.

Of course — it could be that you aren't enjoying model engineering after all!

I don't believe that though — not after the day at the ILS Hot Pot Run — what a novel idea!

Next issue

Production permitting we will present the final 422 installment. A close look at Valves and Valve gears. An elegant steam launch *The Golden Arrow* construction. Plus all our usual goodies.

Classifieds

HAMLEY BRIDGE SA

- Large historic home, Former Railway Station — Circa 1880. Totally Restored $189,000.
  Impressive blue stone building, classic architecture. Comprises large entrance hall, country style family/meals kitchen complete with stainless steel Kleenmaid appliances and original Baltic pine benchtops. Grand entertaining room 12.5 x 4.5m., four bedrooms, two featuring french doors opening to verandah/rear garden. Two heritage bathrooms, main features spa, antique wash stand separate toilet and shower room. Private rear garden with enormous attached iron laced verandah 26 x 4m. Other features include ornate Victorian cornices and ceiling roses quality soft furnishing, five open fireplaces, gardens featuring Jacarandas and roses. This property was built by the government of the day with no expense spared in its original construction and has been restored in a similar manner with the guidance of State Heritage architect Peter Wells.
  The Town — 68kms north of Adelaide, situated between Barossa and Clare wine districts. 15kms from the Roseworthy Railway which has 1km of 7¼" line. Facilities — bowling club, tennis, football, swimming pool, 10 minute drive to golf, community health centre, hospital/retirement homes, schools, resident police, hotel, banks, chemist, supermarket, post office, newsagent, service station etc.
  Heritage statement and photos available on request. Also available separate title, original signal box in good order.
  Phone Phil Dickins (085) 282 324.

7¼" gauge Atlantic For Sale

- Crafstman built three-quarters complete. 4-4-2 with plans and material $6500, Ph (02) 484 3259 please leave message.

Cliff & Bunting For Sale

- 3" scale traction engine by W. Heard. Features Stephenson's valve gear. $8000, Contact: Gordon Blake (067) 22 4272.

7¼" gauge Club — Expressions of Interest

- Starting in Redland area Qld. Interested persons contact Graham Bryen, PO Box 5098, Victoria Point, 4165, PH (07) 3207 8783.

Blowfly Running Chassis

- Including cab etc. Nearly everything except boiler. Some painted $800 or offer Alex Gray (063) 52 1018.

Blowfly Boiler For Sale

- Fitted with regulator, built to AMBSC Specifications. Hydro Tested and registered. POA. Bob Brown (09) 399 1902.

Hand Shaper For Sale

- A Drummond hand shaping machine in good condition, with maker's booklet. $750. J. Dunn (02) 597 2796. 51 Bardwell Rd, Bardwell Park, NSW, 2207.

For Sale: 7¼" gauge Hydraulic Loco

- 7¼" Vic Rail Diesel profile petrol-hydraulic loco, 2 passenger cars, driver's buggy. Loco exterior good; pump, engine, motor and carriages fair. Remainder very poor. Offer wanted. The Wool Factory, PO Box 620, Horsham, Vic, 3402. Ph. (053) 82 0333.

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- Drawings, castings, accessories for 3" to 6" scale. Complete boilers supplied with pressure certificate. Machining and gear cutting service available. Send £5.00 sterling (or alternately quote credit card number and date of expiry) for catalogue and price list to Live Steam Models. Unit 7, Old Hall Mills, Little Eaton, Derbyshire. DE215DN UK Phone: ISD +44 1332 830811
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  MICROCRAFT , PO Box 514 Concord, NSW, 2137
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3¼" Elevated track. Phone Geoffrey (048) 21 3896.

"Metre Maid" plans and Jack Buckler's "Build your own steam locomotive" Contact: Ray Durie, Rylstone Road, Lue, NSW, 2850.

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